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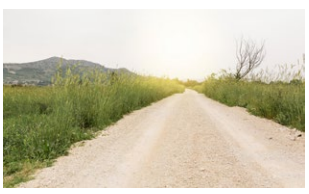

**Jeremiah 29:11**

God said; "I alone know the plans I have for you, plans to bring you prosperity and not disaster, plans to bring about the future you hope for."

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# Contents





***FRONT PAGE:*** *FMC Corporation (NYSE: FMC) is a global agricultural sciences company dedicated to helping producers produce food, feed, fibre and fuel for a growing global population while adapting to a changing environment. FMC's innovative crop protection solutions – including biologicals, crop nutrition, digital and precision agriculture – enable growers, crop advisors and grass and pest management experts to address their toughest challenges economically, while protecting the environment. With approximately 6,400 employees at more than 100 sites worldwide, FMC is committed to discovering new herbicide, insecticide and fungicide active ingredients, product formulations and pioneering technologies that are consistently better for the planet. Visit https://ag.fmc.com/za for more information.*

INSIDE ...




Greenhouse, Aquaponics and shade net covered farming still stay an important way to produce fresh produce, flowers, seedlings and some other crops. During the past summer season we experienced extra ordinary climate conditions which seriously affected agriculture in several parts of the country. Major open land crops like maize, sunflower and sorghum were affected and made a dent in our exports. Talking about exports; intensified delays and inefficiencies at the ports, deteriorating rail and road infrastructure, worsening municipal service delivery, increased geopolitical uncertainty and persistent episodes of load-shedding are all hurdles to be crossed for agriculture, but also many other locally manufactured export products. We are forced to import much of our agricultural requirements, which in turn inflate the producer's expense and thus harm food prices. Meaningful information was conveyed at the recent Undercover Farming Conference in Pretoria (read more in this edition). There is a definite need for proper training, young entrants and continuous information flow on market trends, innovative thinking and news on new systems to ensure quality and quantity of produce in the undercover farming trade in South Africa. This publication, being made available on different platforms with latest weekly news snippets, offers an essential service to all interested in cover protected agriculture. Readers are advised to obtain structural materials and services, electrical gear and pumps, seed and seedlings from reputable companies. All too many small start-ups fail due to poor service or over-night disappearance of fly by nights. We do not have the funds to loose through this. Winter approaches, therefore take heed, double check climate systems in greenhouses and consult your service providers regularly. Be productive, but be wise!

**Irrigation of cucumber plants in a greenhouse. (Pic: Netafim)**

# IMPORTANCE OF IRRIGATION SCHEDULING of Greenhouse Produce

Water is the most important factor limiting yield in agriculture worldwide. Water has always been a scarce commodity in many parts of South Africa, and with water restrictions becoming a reality in irrigated agriculture in some parts of the country we can safely assume that water availability for agricultural purposes may be significantly influenced in the future.

The advantage that farmers with protected crop production systems have is that we can use water more efficiently if we manage it correctly. This is because crop water requirements are considerably less in greenhouses than in open fields when aiming for similar levels of production and is a consequence of the much lower evapotranspiration inside greenhouses because of less wind, reduced solar radiation and higher atmospheric humidity. Accurate management of the irrigation frequency and volume is very important to ensure that the crop uses the water as efficiently as possible.

At this stage it is important to discriminate between crop water use efficiency and irrigation efficiency. Crop water use efficiency is defined by the total amount of marketable produce per volume of water lost through evapotranspiration. What this means is that the crop uses what it requires and will not necessarily use more water if it receives more. All the water that is not used by the crop is therefore wasted and this is where irrigation efficiency is differentiated.

The term irrigation efficiency therefore reflects on the marketable produce per volume water applied. This definition includes the total volume of water applied which includes productive (transpiration) as well as unproductive (evaporation, runoff and drainage) water losses. Unfortunately, drainage is something that we cannot go without when we fertigate on each irrigation event. So the question arises: how can we try to reduce these unproductive water losses?

The suggested answer is, to develop and adopt an irrigation strategy

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of only supplying the plant with water when it requires it. It does make sense that if you irrigate less frequently, you will have less drainage and evaporation. This does not mean that we should only irrigate when we see the plant wilting, because wilting only sets in after the plant starts to experience moderate or elongated water stress.

The most direct way to monitor when the crop requires water, is to monitor the source from which water uptake takes place, i.e. the medium or soil. This may be done with the help of soil water sensors and the medium/ soil may be irrigated as soon as the medium reaches a certain level of "dryness".

It is important to remember that we can only apply lower frequencies if we are working with a medium or soil with a good water holding capacity.

This strategy of monitoring the medium/soil water content was tested in practice for tomatoes and cucumbers grown in coir.

Depletion levels used comprised of a standard treatment (STD) and treatments where water was depleted to a level just before stress (BS) and at mild water stress. For the STD treatment, the medium was held close to the drained upper limit by using frequent irrigation events (8 times per day).

For the BS treatment, water was depleted to approximately 60% of field water capacity for tomatoes and 80% of field water capacity for cucumbers before irrigation was triggered. A drainage percentage was maintained over all irrigation treatments to prevent salt accumulation in the medium.

Figure 1 shows the difference in the amount of irrigation and drainage, as well as yield for tomatoes.

The yield was lower with BS than STD for tomatoes and it is evident that depletion to 60% was a bit extreme. Improved results were achieved with cucumbers grown in coir at depletion to 80% of field water capacity (Figure 2).

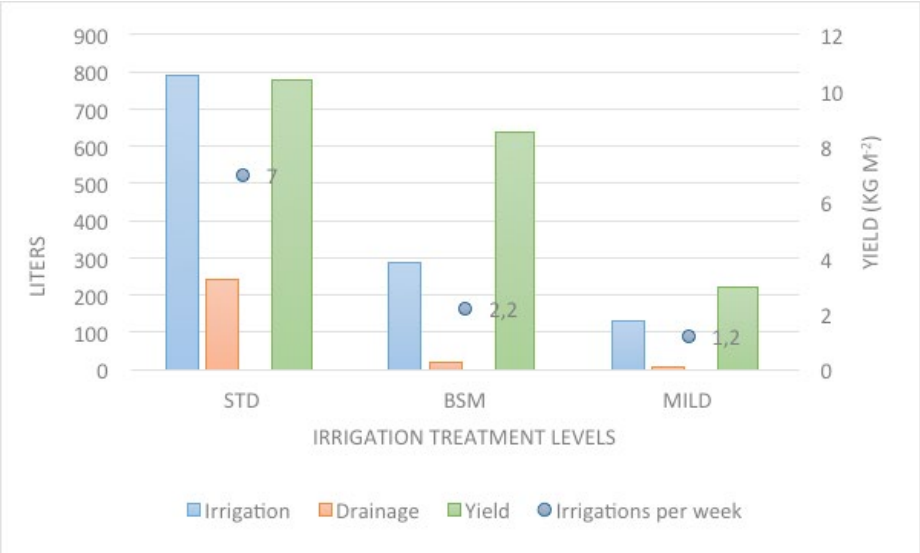


**Figure 1: Irrigation, drainage and yield levels of greenhouse tomatoes grown in coir for different water depletion levels.**

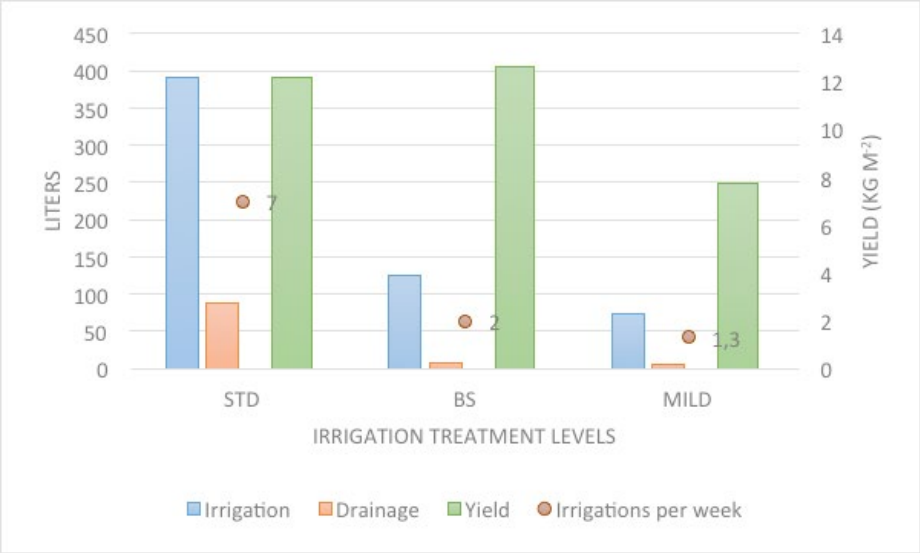


**Figure 2: Irrigation, drainage and yield levels of greenhouse cucumbers grown in coir for different water depletion levels.**

The cucumber yield was improved by this strategy, while the overall applied irrigation volume was greatly reduced.

There are a variety of methods used to schedule irrigation in greenhouses, of which irrigation based on time, irradiation sum and vapour pressure deficit is probably the most common strategies.

The last two methods are used to predict a crop's water requirement based on environmental conditions. In contrast, direct monitoring of the medium/soil's water content provides realtime information of the crop's water use and automatically adjusts frequency and volume according to crop requirement.

Soil water monitoring is an established practice in irrigated agriculture in the soil, but can be applied with just as much success in greenhouse mediums/soils if managed correctly. Given the water scarce times that we live in, it may be a good alternative strategy which can help the producer maintain yield while saving on fertilizer and water.

**By: Dr. Rykie van der Westhuizen: Crop production specialist)**

RIJK ZWAAN

# MAXIMIZING YIELD WITH CHANTUS RZ F1

## in Shadenet and Open-Field Cultivation

For tomato growers in South Africa, the pursuit of maximizing yield amidst unpredictable weather and environmental challenges is a constant endeavor. Chantus RZ F1 emerges as a game-changer, offering tomato growers a versatile cultivar capable of thriving in both shadenet and open-field environments. This editorial delves into the strategic advantages of integrating Chantus RZ F1 into cultivation practices, focusing on how it empowers tomato growers to overcome challenges and achieve unprecedented levels of success.

### Supporting Tomato Growers with Shadenet Cultivation

Shadenet cultivation has become a lifeline for tomato growers, providing a shield against harsh weather conditions and pest pressures while ensuring consistent yields and quality produce. Chantus RZ F1 stands out as an ideal choice for shadenet cultivation, with its robust plant structure and adaptability to controlled environments. By harnessing the protective capabilities of shadenet alongside Chantus RZ F1, tomato growers can mitigate risks and optimize crop performance, giving them greater control over their harvests.

### Maximizing Flexibility with Chantus RZ F1

What sets Chantus RZ F1 apart is its versatility. Not only does it excel in shadenet cultivation, but it also thrives in open-field environments with remarkable success. This flexibility is a game-changer for tomato growers, providing them with options to adapt their cultivation practices based on their specific needs and resources. Whether it's the controlled conditions of shadenet or the openness of the field, Chantus RZ F1 ensures growers can maximize yield regardless of the environment.

### Unlocking Potential for Sustainable Success

Beyond its adaptability, Chantus RZ F1 embodies principles of sustainability that resonate with today's conscientious growers. By reducing reliance on agrochemicals and optimizing resource utilization, this cultivar aligns with the ethos of sustainable agriculture. Moreover, its ability to thrive in both shadenet and open-field settings enables growers to optimize land usage and minimize environmental impact while maximizing productivity and profitability. Chantus RZ F1 thus becomes not just a tool for yield maximization but a partner in sustainable growth for tomato growers.

### Embracing Innovation for Grower Success

Innovation is the cornerstone of success for tomato growers navigating the complexities of modern agriculture. By embracing Chantus RZ F1 and its adaptability to different cultivation environments, growers can leverage innovation to overcome challenges and seize opportunities. Collaboration, knowledge sharing, and investment in research and development further amplify the potential of Chantus RZ F1, paving the way for a sustainable future where growers can thrive amidst changing climates and market dynamics.

### Partnering for Grower Prosperity

**In conclusion, Chantus RZ F1** represents more than just a tomato cultivar; it symbolizes empowerment for growers seeking to maximize yield and sustainability. Whether in shadenet or open-field cultivation, Chantus RZ F1 stands as a beacon of hope, offering growers the tools and flexibility they need to navigate uncertainties and achieve success. By growing Chantus RZ F1, tomato growers can embark on a journey of growth and innovation, shaping the future of agriculture in the South African tomato market.

# Chantus RZ

**Rijk Zwaan's tomato breeders select varieties to help you succeed and ensure consumers can enjoy tasty tomatoes.**

**Nature offers great diversity in every perspective, from changing weather patterns and increased disease occurrences, to new fruit shapes and tastes. All of this diversity offers opportunities to develop new varieties. Rijk Zwaan continually endeavours to expand our varietal development to evolve with and benefit from this diversity. Within our Tomato assortment, we offer varieties suitable for all cultivation methods in most geographical regions.**

Highly Resistant: ToMV:0-2/For/Pf (ex Ff): A-E/Va:0/Vd:0
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RIJK ZWAAN

# EXCEPTIONAL INSECT CONTROL with world-class active ingredient

**New generation Circaden® insect control, powered by the Cyazypyr® active, is a revolutionary product that provides early season insect protection for healthier plants from start to finish. It delivers a unique action against a wide spectrum of sucking and chewing pests for a more resilient crop. Applications early in the crop cycle can help protect tender seedlings from nutritional damage and transmission of certain insect-borne diseases, especially when used as part of a pest management programme.**

New generation Circaden® insect control, powered by the Cyazypyr® active, is a revolutionary product that provides early season insect protection for healthier plants from start to finish. It delivers a unique action against a wide spectrum of sucking and chewing pests for a more resilient crop. Applications early in the crop cycle can help protect tender seedlings from nutritional damage and transmission of certain insect-borne diseases, especially when used as part of a pest management programme.

Circaden® 200 SC insect control from FMC is now available in South Africa and offers broad-spectrum control in crops against harmful insects such as whitefly, aphids, thrips, leaf miners and Lepidoptera. Circaden® 200 SC improves crop establishment in crops such as tomatoes, peppers and cabbage, through early season soil application during planting or transplanting (soaked seedling trays or drip irrigation).

"Cyazypyr® in Circaden 200 SC is a world-class active ingredient that controls a wide spectrum of damaging insect pests" explains Ben Schoonwinkel, FMC's Head of Business for South Africa. "It is an excellent option for growers to use in an early application to promote plant establishment and growth, especially in vegetables. Crops respond very well and show exceptional plant health in the early stages due to the reduction of crop stress."

Cyazypyr® is a potent anthranilamide insecticide that enables growers to control several key pests. A large number of field, greenhouse and laboratory studies conducted in many countries have shown that Cyazypyr®containing products are very effective against various species of both chewing and sucking pests, in a large variety of crops.

The unique properties of Cyazypyr® allow selective control of pests while preserving beneficial arthropods. Cyazypyr®based insecticides have an excellent ecotoxicology and environmental profile. These properties make Cyazypyr® a valuable element of integrated pest control and is compatible with IPM programmes. Depending on local cropping systems and temporary pest occurrence, Cyazypyr® can be applied either as a soil application (pre-transplant drench) or by drip irrigation.

Cyazypyr® is part of Group 28 according to the IRAC mode of action classification scheme. Thanks to its unique mode of action on sucking pests, Cyazypyr® has shown equal performance against susceptible and resistant pest populations. Laboratory results show that Cyazypyr® is not affected by resistance mechanisms known to confer resistance to other insecticides.

The insecticide binds to ryanodine receptors which can be found on the sarcoplasmic reticulum of the insect muscle. The activation of those receptors causes the release and depletion of intracellular calcium leading to muscle contraction and paralysis. Symptoms include rapid cessation of feeding, general lethargy, paralysis and eventual pest death. These features help prevent direct crop damage and slow the transmission of some plant virus and bacterial pathogens spread by thrips and Hemiptera pests such as whiteflies or aphids.

With all the benefits of Cyazypyr®, long-acting Circaden® 200 SC offers a unique action that effectively influences insect behaviour by impairing muscle function. Insects rapidly stop feeding, resulting in excellent plant protection. In addition, Circaden® 200 SC has a favourable environmental profile and is ideal for IPM programmes.

To find out more about how Circaden® 200 SC insect control can increase the vigour of your crops for stronger, healthier plants with better quality and higher yields, visit the FMC website at www.ag.fmc.com/za/en or contact your nearest FMC area manager.

Circaden® 200 SC, Reg. No. L11488, Act No. 36 of 1947, contains cyantraniliprole (anthranilic diamide) – 200 g/l (Cyazypyr), caution, harmful if inhaled, very toxic to aquatic life with long lasting effects.

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Insect control
POWERED BY
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POWERED BY CYAZYPYR® ACTIVE

New generation CIRCADEN® 200 SC insect control from FMC offers broad-spectrum control in crops against harmful insects including important species of whitefly, aphids, thrips, leaf miners, beetles and *Lepidoptera*. CIRCADEN® 200 SC improves crop establishment in crops like tomatoes, peppers and cabbage through early season soil application during planting or transplanting (seedling tray drench or drip irrigation). Long-acting CIRCADEN® 200 SC delivers a unique action that affects insect behaviour by impairing muscle function. Insects quickly stop feeding, resulting in excellent plant protection. In addition, CIRCADEN® 200 SC has a favourable environmental profile and is ideal for IPM programmes. Increase the vigour of your vegetable and fruit crops for stronger, healthier plants, better quality and greater yields.

Contact your nearest FMC Area Manager to find out more about the many benefits of CIRCADEN® 200 SC insect control.

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Seedlings ready for transplanting.

# IN THE BEGINNING

## It all starts with quality seedlings

Producers of fresh produce largely depend on a trusted seedling producer to supply quality seedlings in order to obtain as close to a hundred percent perfect harvest as possible. The growing of tomato seedlings, for one, mainly depends on certain factors the seedling grower needs to control.

**Good seed quality**

In order to be successful it is most important to select quality seed from the right variety according to the client's specifications. Poor quality seed could easily make a difference in germination of between 60% and 95%. It is therefore important to know what the laboratory requirements are for a specific seed lot. Different seed lots may require temperatures of between 20°C and 26°C to germinate.

This is a quality seedling with good root formation.

Also necessary to know is how many hours the seed needs to be kept at these temperatures – it ranges from 72 to 96 hours.

**Grow media**

The seedling grower needs to have in-depth knowledge of grow media before he attempts to use it for his seedling production. For instance; just to know exactly what the status is of the pH and EC in the particular medium he chose to grow seedlings with. Also, he must know the AFP status, since all these factors play an important role not only to ensure proper nutrition intake by the plant but also the manner in which the seedling grower schedules his water program.

**Water quality**

With seedling growing, water quality is of primary importance. Be sure of the purity of the water and that it is absolutely pathogen-free like for instance from Pythium, Phytophtora, Fusarium, etc. The pH of the water should ideally be in between 5.5 and 5.6 and the EC not higher than 0.6 mS/m. It is essential to do regular tests of the water before it flows to the seedlings.

**Nutrition program**

Top quality seedlings can be grown by following a complete nutrition program. It will consist of a NPK mixture with all trace elements necessary for healthy plants.

**Pest control**

Chemical pest management is still used under certain circumstances, but biological pest management is taking off well. It is of most importance to implement a preventative spraying program. In the seedling production trade one cannot wait for problems to surface – one needs to pre-empt at all times.

The hardening-off of seedlings is an important issue in order to obtain a 100% plant stand. This is achieved by revising the watering schedule downwards coming closer to the planting-out date.

Some seedling growers tend to use growth inhibitors to harden-off their plants. The growing period for tomato seedlings may differ from 24 to 35 days.

Most serious greenhouse growers make use of a reputable seedling grower. The advantage is mainly that the seedling growers continuously visit seed companies' trials and can advise the producer on varieties.

The seedling grower takes the responsibility of sowing, growing and hardening off of seedlings and delivery on the right date to the producer.

This saves the producer time, space and money since, if the seed does not germinate in time, evenly and healthy, it may incur a loss which could have been avoided should he rather had a seedling grower take the responsibility.

**Source: Moorland Nurseries, Jeffries Bay.**

# UCF CONFERENCE OVERVIEW:


## SUCCESSFUL UNDERCOVER FARMING CONFERENCE AT CSIR, PRETORIA ENDED 7 MARCH

The two days Conference was once more marked by reputable speakers on a variety of subjects that made much impact on the visitors. During the question and answer period after each presentation it was remarkable how many visitors out of the crowd asked most intelligent questions from which the rest may learn. This alone is a sure sign of a successful Conference and strong motivation for future conferences.

The presenters varied widely in subjects offered to the audience. The success of any conference is measured by the varied topics by speakers, the active participation by attendees and the ease of access to the venue. In all these aspects the conference succeeded.

**Marion Oosthuizen** and his team welcomed all and offered a program with speakers on subjects of current interest. Deon van Rooyen of Vegtech/Netafim opened the platform with his subject "New greenhouses and automatic innovations – The important role of humidity control." Deon is known to be an 'old salt' in agronomy with a good number of years' experience. While the season is changing, greenhouse operators have to consider humidity control in all earnest.

**Tom Murray**, Technical Manager of Woolworths gave a "glimpse into the not-too-distant future." He reiterated quality control and the trends followed to ensure quality fresh produce. He reiterated the fact that early detection of diseases on crops and instant control, if not preventative control is important. The world leans towards pesticide-free pest control, therefore producers are advised to be utmost careful with their spray programs and general plant hygiene. Pending legislation for a 'Globally Harmonised System' for labels on agri chemical is on the cards. Murray warned about a pesticide problem during 2024.

Also from Woolworths, **Kobus Pienaar** stressed the fact that global changes need producers to be alert of market tendencies, become more resilient in their approach to farming, address weak areas in the production system and be cognizant of the farm's financial stability. He warned that 'stressful farmers' build banks therefore, financial independency (as far as possible) is important. No decision can be made without science on produce and market relativity. Regenerative agri practices are essential.

**Johan Fick** from SQM, a 'solutions for human progress' company, explained why Iodine is a plant-beneficial element in plants. It controls metabolic improvement, and adds to the plant's well-being, therefore, productivity. Iodine is a necessary element in water fed to plants. In South Africa though, water contains less than one micron per liter and added Iodine is required. SQM markets a product combatting Iodine deficiency in plants.

**Nokuthula Mayeza** from Dube TradePort presented an interesting overview of Dube TradePort, the greenhouses and related infrastructure, backed by pictures of the lay-out of Dube TradePort's complete plan, including the airport,

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office park, business warehouses and current additions-planning to the enormous complex.

**Herbert Stölker** of Delphy reiterated the importance of pH control in the greenhouse irrigation system. He stressed the fact that poor management of the water system simply leads to poor plant production and the possibility of weakness which could inspire plant diseases.

During the second day of the Conference, FNB's **Dawie Maree** gave an overview called "Agricultural Outlook 2024 and Beyond." He explained financial markets' international instability but pinned hopes on the global aftermath of political outcomes.

**Stiffie du Plessis** of Santam delivered a presentation on important economic facts concerning the economy and management of packhouses. Producers pin their hopes in good outcomes after having delivered to packhouses, but if the chain to the consumer fails somewhere, it bounces back economically to the farmer.

**Martin von Holdt** of Greener Solutions addressed the conference on "Sustainable and Efficient management of water and nutrients, but specifically enlightened the attendees on the re-use of run-off water; the management of its purification before re-entering the system being an utmost important factor.

**Lindi Herbst** of Agri Alchemi is a popular speaker at Undercover Farming Conferences for years. This time her subject was "Future Proofing your farm through soil management. For those greenhouse farmers planting in soil, it is very important to pre-empt their future plantings by having regular soil test done and ensuring the correct soil mixes are ready for new plantings.

**Francois Fourie** of Turf Technology and Irrigation named his presentation "Taking your fertigation to the next level." A well-researched prescription for fertigation to plants is an absolute must in order to offer greenhouse plants a balanced requirement for it to produce optimally.

**Suzanne Oosthuizen** of Rijk Zwaan SA gave an interesting, yet important account of "Importance of the grower – retailer – consumer link for successful farming in SA". This subject counts for greenhouse producers as much as it does for irrigated land farmers.

**Nico Uys** of Ezolimo Organics discussed "The role of bio-stimulants and bio-fertilizers in agriculture." The usage of bio-products on fresh food producing plants is becoming more important by the day. The world is steering away from foodstuffs grown under 'chemical-protected' circumstances and the vast research on bio-products proved its success in plant growth and production.

Marion ended the Conference by thanking all that attended, speakers and all assistants in the organizing team. Thus the 2024 Undercover Farming Conference at CSIR in Pretoria concluded and attendees returned home most satisfied. **JS**








Peat used in the growth mix for seedlings.

# PEAT-BASED GROWING MEDIA OFFER UNIQUE CROP SECURITY

Peat as a substrate raw material is widely used in the production of growing media. Currently, peat is indispensable for use in commercial horticulture.

Peat-based growing media offer unique crop security for the whole diversity of crop plants. Eliminating peat from growing media diminishes crop security. Peat-based growing media can be produced and delivered in consistent quality. Of the huge areas of raised wetland that exist in the world, only a very small part is used for peat extraction. Intact bogs are nature conservation areas, and are left untouched.

In line with the voluntary commitments made in the "Responsibly Produced Peat" (RPP), raw materials are exclusively collected from peat wetland areas that were drained decades ago, when this process was still the politically and socially accepted practice. More than 70% of peat resources come from RPP certified extraction sites. This includes all sites in Lithuania as well as many important sites in Latvia and Germany. All RPP criteria were met for these sites.

The peat extraction areas are subject to very strict legal regulations, which stipulate the performance of re-naturation once peat extraction has ended. In particular through re-wetting, they convert former extraction areas into typical bog-like landscapes where peat moss can begin to grow again.

After being duly processed, the various peat types have optimum physical, chemical and biological plant cultivation properties which, taken all together, cannot be matched by any other raw material. Other raw materials, such as wood fibre, compost and coco pith, form an excellent supplement to peat. But these materials only achieve their desired horticultural effect in combination with peat.

Raw peat materials are available in sufficient quantities to cover the world-wide demand for growing media. Ceasing to use peat in growing media would cause a gap in the supply chain. Alternative raw materials such as wood fibre and compost are not available in sufficient quantities to allow peat-free growing media to be produced on the required scale – neither for Germany, Europe or the world as a whole.

The supply of such alternatives could also be still further diminished, and their price could rise, as they become increasingly attractive for energy uses in future. Only 15% of alternative substrate consists of raw materials - every substrate raw material causes emissions, though in different amounts. Peat is among the raw materials with comparatively high CO2 values because in contrast to wood fibres and compost, it does not count as a renewable raw material.

The targeted use of volume-forming substrate raw materials in place of peat has a positive impact on the carbon footprint of this growing media. A goal was set of increasing the share of alternative substrate raw materials by 15% of the annual output volume in this decade.

**Source: Seeds for Africa**

Peat as a raw material is used in the production of growing media.

Peat being harvested.

# TOMATO PRODUCTION: THE IMPORTANCE OF YIELD

**A well-formed truss of tomatoes.**

**Tomato harvesting time. (Pic: LA Visagie)**

**A neat greenhouse where tomato plants will flourish.**

Tomato producers need to take a close look at the different varieties on the market. When comparing varieties, growers often use yield as the most important determining factor. For sure the tomatoes must also be of high quality and thus marketable, the disease resistance must be good, and so on. The question however is; what makes one variety different from another when it comes to yield advantage?

Yield is made up of two factors – fruit size and fruit number. Fruit size is affected by the genetic capacity of the variety, the overall fruit load, management and climatic conditions. Most growers assess relative fruit size optically during the life of the crop and pay particular attention to the fruit size at the end of the crop cycle. Very often a grower will use fruit size as a critical selection factor and will dismiss a variety as having fruit that is too small (on observation only) without really paying any attention to the overall yield.

What is probably more valuable to assess is fruit number, or fruit load. All things being equal this is usually a reaction of the ability of the variety to set fruit, i.e. to turn flowers into fruit. This is the one single factor that sets two varieties apart in their ability to yield well, particularly under difficult conditions.

Some time ago planting of a very well-known and widely planted variety was assessed in Mpumalanga. It reiterated the importance of thorough and uniform fruit set. The seedlings were transplanted in early January, and the third truss was showing yellow flowers at the time of assessment. It was immediately obvious that trusses one and two had suffered from poor set. On each truss only two or 3 flowers had set fruit. The rest had dropped off, or would set so far behind the primary fruit as to be too small to be marketable.

This meant that at least 3 flowers per truss had failed to set. January and February are very hot months in Mpumalanga, and despite the best efforts of a very good grower the conditions were too extreme for this variety to set fruit properly. A similar trend was also seen in early summer at the same farm, so one can easily conclude that this particular variety, while good in other ways, has a problem with fruit set in the heat.

When comparing the experimental varieties under evaluation showed not only complete set, but also uniform set. On each truss five to six fruit had set more or less at the same time, and conspicuously on the flowering truss, all the flowers were open at the same time. Uniform flowering means pollination at the same time, leading to even fruit size and also ripening and harvesting at the same time. These varieties originate from a breeding programme known for good heat set and which has already delivered a top performing variety.

This is an easy observation to make in the field, and intuitively one knows that good fruit set is better, but what is this characteristic really worth to the grower? Given that a grower has a plant density of 25 000 plants per ha, under shade net - if one assume an average fruit size of 140g and give the variety the benefit of the doubt by considering that only the first two trusses are problematic, i.e. one assume that the later trusses set 100 per cent, then the producer can calculate the lost value per fruit, and per ha for different market prices.

For his high quality fruit the grower in question would probably expect to average a gross return of around R3.50 per kg for his total crop, over a total planting of about 5ha. Losing two flowers on just the first two trusses due to poor fruit set in the heat could cost this grower a whopping R250 000! To make this situation even more painful, this loss is from the bottom line, as all the planting, establishment and production costs still have to be paid, whether there are five fruit on the truss or three.

Perfect set, where either a fruit sets or the flower drops, is not the only important factor – equally important is the ability to set fruit on a truss at more or less the same time.

When selecting a variety, pay attention to the uniformity of flowering, the uniformity of fruit set and the ability to set fruit under a range of climatic conditions. This one point could make a huge difference to the producers' bottom line. TPO

# SAFE WATER QUALITY FOR CROP PRODUCTION – AN IN-DEPTH LOOK AT CRITICAL WATER QUALITY

In South Africa, producers and public are faced with poor water quality in most areas. This is brought about by degrading filtration systems, over populated areas adjacent to productive farmland, to name but two factors.

Irrigation water quality is a critical aspect of greenhouse crop production. There are many factors which determine water quality. Among the most important are alkalinity, pH and soluble salts. But there are several other factors to consider, such as whether hard water salts such as calcium and magnesium or heavy metals that can clog irrigation systems or individual toxic ions are present. In order to determine this, water must be tested at a laboratory that is equipped to test water for agricultural irrigation purposes.

Poor quality water can be responsible for slow growth, poor aesthetic quality of the crop and, in some cases, can result in the gradual death of the plants. High soluble salts can directly injure roots, interfering with water and nutrient uptake. Salts can accumulate in plant leaf margins, causing burning of the edges. Water with high alkalinity can adversely affect the pH of the growing medium, interfering with nutrient uptake and causing nutrient deficiencies which compromise plant health.

Reclaimed water, runoff water, or recycled water may require reconditioning before use for irrigation since disease organisms; soluble salts and traces of organic chemicals may be present.

Water quality should be tested to ensure it is acceptable for plant growth and to minimize the risk of discharging pollutants to surface or ground water.

**Filters**

Suspended solids need to be removed from water to prevent clogging of piping, valves, nozzles and emitters in an irrigation system. Suspended solids include sand, soil, leaves, organic matter, algae and weeds. Ground water, although usually clean, may contain fine particles of sand or other particulates. All of these can be removed through filtration. Before selecting a filter, a water analysis should be done.

**pH and Alkalinity**

Alkalinity and pH are two important factors in determining the suitability of water for irrigating plants. pH is a measure of the concentration of hydrogen ions (H+) in water or other liquids. In general, water for irrigation should have a pH between 5.0 and 7.0. Water with pH below 7.0 is termed "acidic" and water with pH above 7.0 is termed "basic"; pH 7.0 is "neutral". Sometimes the term "alkaline" is used instead of "basic" and often "alkaline" is confused with "alkalinity".

Alkalinity is a measure of the water's ability to neutralize acidity. An alkalinity test measures the level of bicarbonates, carbonates,

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and hydroxides in water. These compounds get into the water from the geologic materials of the aquifer from which the water is drawn, such as limestone and dolomite

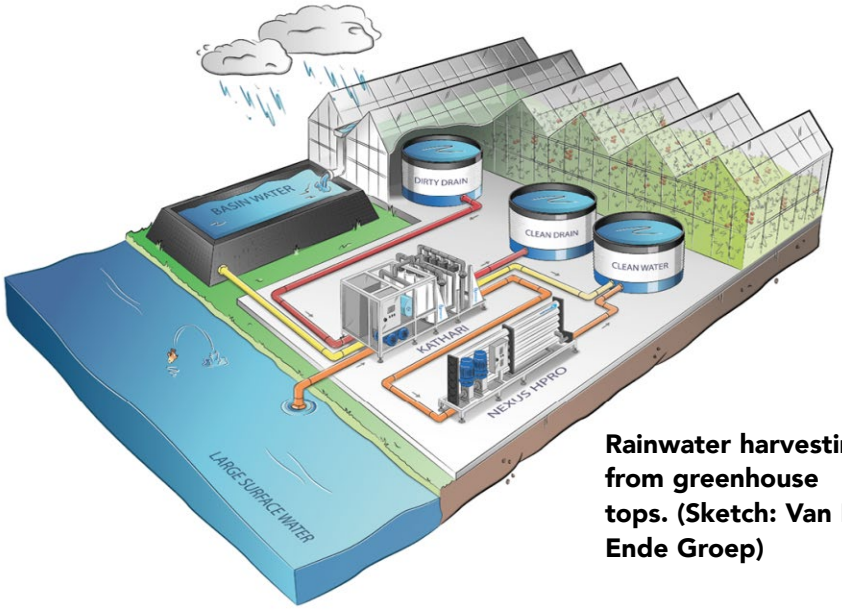
**Adverse effects on nutrition**
In most cases irrigating with water having a "high pH" causes no problems as long as the alkalinity is low. High pH water has little effect on growing medium pH because it has little ability to neutralize acidity.

Of greater concern is the case where water having both high pH and high alkalinity is used for irrigation. The problem is most serious when plants are grown in small containers because small volumes of soil are poorly buffered to pH change. Therefore, the combination of high pH and high alkalinity is of particular concern in plug and seedling trays.

Trace element deficiencies such as of iron and manganese and imbalances of calcium (Ca) and magnesium (Mg) can also result from irrigating with high alkalinity water. To determine if a pesticide is affected by high pH or high alkalinity, carefully review the product's label. A call to the manufacturer may be needed to find the information for some chemicals.

**Adjusting Alkalinity with Acids**
Acidification of water having high pH but low alkalinity is rarely necessary, but many greenhouse operators inject acid (e.g., phosphoric, nitric, or sulfuric acid) into water with problematic high levels of alkalinity. The use of acid injection should be considered very carefully for several reasons. It is an extra step in production which will require additional materials and equipment and are dangerous to handle and may damage some injectors and piping systems.

**Calculating the Amount of Acid to Use**
It is suggested to use enough acid to reduce water alkalinity to within a target range. You can have a lab test your alkalinity or you can use a kit to measure it yourself (alkalinity test kits can be purchased through greenhouse or scientific supply distributors). Then, calculate the amount of acid needed to get the water into your target alkalinity range. (Current alkalinity - desired alkalinity = alkalinity to be neutralized).




**Rainwater harvesting from greenhouse tops. (Sketch: Van Der Ende Groep)**

**Fertilizer Compatibility**
Many growers want to use one injector and mix acid with fertilizers. The use of sulfuric, nitric and citric acid is compatible with most water-soluble fertilizers. Phosphoric acid is not compatible with calcium-containing fertilizers like calcium nitrate or formulations like 15-0-15 and 17-0-17 in concentrated form.

Remember, you only put in some of the acid to carry out the calibration run (half volume of stock solution). Add the remainder of the acid for the total amount of acidified water you wish to make. You may add more water, allowing "room" for fertilizer addition. Add the fertilizer carefully to avoid splashing, and add enough water to attain your final volume - mix thoroughly.

Before investing in any treatment system, however, it may be advisable to investigate the possibility of switching to an alternate water source, or mixing water sources, if it is an economical alternative for solving a water quality problem.

**Blending with Rainwater and Other Non-Problem Water**
Rainwater can be collected from roof runoff structures, such as greenhouses, where it is then stored in a cistern to be used as irrigation water. Collected rainwater could also be blended with problem waters such as those with high alkalinity, high EC, or excess Na and Cl or to improve the quality of recycled tail water and industrial wastewaters with high nutrient content used for irrigation. Other non-problem sources of water could also be used for blending.

Rainwater should be collected from clean, well-maintained structures free from mineral contaminants such as zinc and other metals. Water should be tested for pH and minerals at least twice a year. By: Bartok, J.W. et al, UMass.

There are alternative sources, but none of them provide water that can be used immediately for irrigating crops. They need at least to be treated with reverse osmosis. This makes it possible to remove ballast substances, such as salts, from the water, ready for greenhouse irrigation. Nearly all the unwanted elements have then been removed. An important advantage of a good filtration system which is extremely efficient is a plus point that becomes even more beneficial at times of high energy costs.

# ECONOMICS OF PUMPS, ELECTRICS AND BACK-UP SERVICE FOR GREENHOUSE

**Supplemental lighting in a cannabis greenhouse (Pic: Zane Stadler)**

One of the most talked-over subjects by greenhouse operators is the high electric expense and intermittent service. In most greenhouse operations, the electric bill is about 5-10 per cent of the total energy cost and covers such items as the power to run motors, lights, heating elements and controls. Electricity costs are increasing ever and anon as with fuel prices. Although this seems very gloomy, there are greenhouse farmers that plant their businesses well to overcome most of these obstacles.

The demand for electricity has been increasing rapidly over the last few years due to greater use of electronic devices and machinery. In many sections of the country, electric utilities are operating at maximum output that is, if there is no load shedding! As yet there is not an incentive to build new private plants to sell their generating capacity. Companies that purchase these plants can sell the electricity for whatever the market can bear.

Conservation may be the only way that growers have to offset the rise in energy costs. Proper installation and maintenance are two ways to achieve significant savings.

**Electrical service**

The electrical service must be of adequate size to handle the load. Adding greenhouse space frequently overloads the system and causes circuit breakers to trip. Early planning coupled to ensuring of adequate availability of electricity is of essence before expansion takes off.

In calculating load, it is necessary to make a complete list of electrical equipment, giving full-load amperes and operating voltage. Next, identify the equipment that will be operating simultaneously. This has a demand factor of 100 per cent. The next 60 amps of all other loads are assigned a demand factor of 50 per cent, with the remainder assigned at 35 per cent. An additional amount, usually 25 per cent, should be added for future expansion or for additional equipment.

To avoid multiple base charges, all the greenhouses and accessory buildings should be served by one electrical service. It is usually less expensive if a farm rate can be obtained rather than a commercial rate that has an associated demand charge.

**Insulated Wiring**

To meet the Electricity Installations Regulations, the wire type should have insulation to fit the application: wet, dry or high-temperature. In many greenhouse locations, especially where moisture and dust are present, the code requires that the wiring be placed in conduit. Polyvinyl chloride (PVC) conduit is a good choice as it is corrosion-resistant, watertight and easy to install. Watertight electrical boxes and receptacles should also be included in the system to keep out moisture and dust.

A problem common in greenhouse operations is using wire diameter that is too small for the size of the load. This is a frequent cause of fan and furnace motors overheating and failing. It also uses extra electricity that is converted to heat in the wires. An electrician can provide information on the correct wire size. The size is based on the amount of amperage, length of wire and type of insulation.

**Service Motors Regular**

Electric motors power most of the greenhouse equipment use, and given minimum care, they will offer many years of service. The following service operations should be provided at least once per year and more often if the motor operates under severe heat, cold or dust conditions.

- Keep motors free of dust and dirt, which can restrict airflow across the windings. Vacuum them at least once a year.

- Follow the manufacturer's recommendations for lubrication and proper cleaning to maintain

the equipment that the motor is powering. Sealed bearings do not need lubrication.

- Check wiring and replace worn or frayed wires.
- Clean switch contacts using electrical contact cleaner.
- Check pulleys and belts. Replace belts that are worn and adjust tension so that there is a two-inch deflection halfway between the pulleys. Be sure that the pulleys are secure on the shaft and aligned.

**Motor replacement**

When a motor fails, determine the cause. An overloaded motor runs hot, slow and draws more than the nameplate amperage. It may give off an odour of burning varnish or trip the thermal overload switch. You cannot tell by touch if a motor is running hot, as the normal operating temperature is generally 32 - 49°C above the air temperature to burn your hand.

A common cause of motor overheating in a greenhouse is low voltage. This can be from a wire size that is too small for the distance from the electric source or from too many motors or electrical devices connected to one line. Use a volt/amp meter to check the voltage and current when the motor is operating.

A defective motor should be replaced with one of the same horsepower rating and voltage. Today, consideration should be given to installing a high-efficiency model. These motors use more electrically conductive materials than comparable standard motors and convert more electrical energy input into mechanical, load-driving output.

For example, a 1-horsepower, capacitor-start motor operating on 115 volts draws 13.6 amps, whereas a similar, high-efficiency motor will draw only 9.2 amps; a 32 per cent saving. High-efficiency motors cost slightly more initially, but this cost is quickly recovered. Check with your electric company to see if there is a rebate program for the replacement of inefficient motors.

**Fine tuning all installations in the greenhouse, even such as this example, is of importance but need not be costly.**

**Save on Lighting**

Selecting the right light source can save money on the electric bill. With an average of 16 lumens per watt and 1,000 hours average life, incandescent lamps should not be used anywhere in your operation. Fluorescent lamps in 1.2- or 2.5-meter lengths, or the newer compact design, will give about 75 lumens per watt and operate for 12,000 hours. Although the initial cost is greater, the savings in electricity will pay this back quickly. Cool white fluorescent bulbs also give a light spectrum close to sunlight.

For areas that are lighted for long periods of time, high-intensity discharge lighting may be a better choice. These produce light when an electric current is passed through a gas or vapour under pressure. Efficiency is about the same as fluorescent, but the life of the bulb can be up to 20,000 hours. Metal halide gives a white light and is good for work areas. High-pressure sodium provides a yellow light and is slightly more efficient with about 110 lumens per watt.

Lighting should be installed to provide adequate but not excessive light for the task that is being done. For potting, transplanting and office areas, 6-8 meter candles are needed. For storage areas, 6 meters are enough. Use an inexpensive light meter to check the level.

**Supplemental Lighting**

Supplemental plant lighting in a greenhouse may be required but to save on energy, a computer system should be installed that integrates the daily sunlight with enough hours of supplemental light to provide for the needs of the plants, but not an excessive amount.

For all tasks, a uniform pattern of light should project over the work or plant area. This requires careful selection and spacing of the fixtures. Most lighting equipment suppliers

**A neat electricity switch and metering system.**

have computer programs that will give the best placement.

Security lighting in parking lots and around buildings consumes considerable electricity because the lights operate for 12 hours a day or longer. Installing motion detectors to control the light can produce significant savings; it has been found that trespassing and break-ins occur less frequently if the lights are not on all the time.

**Watering systems**

At current high electricity rates it is inevitable to make good use of every drop of water to reduce the electricity expenses.

For each kilogram of fresh matter produced as many as 20 liters of water move through the plant. With many irrigation systems to choose from, it is important to select one that will provide adequate water without wasting it. Traditional overhead systems apply water in a circular pattern and irrigate both the plants and the area in between. As much as 80 per cent of the water may not reach the root system of a crop of potted plants.

Trickle systems place the water near the root system where it is needed. Moisture is supplied to the root zone through drip tubes or emitters, which can save up to 75 per cent in water costs. The foliage also remains dry, an advantage in reducing disease problems.

The most flexible systems use programmable controllers or micro-computers that allow speed changes, skipping of empty bench areas, and the selection of dripper / leaf sprayer section to ensure accurate water provision to every plant or seedling.

Ebb-and-flood systems recycle excess water and nutrients and prevent potential groundwater pollution. A tank large enough to store all the solution requires a pump that supplies watertight benches, floor beds or troughs. A controller programs the length of time the water is available to the plants. Every pot or flat gets the same amount of nutrient solution. Energy is reduced as less water is needed.

**Friction Loss, etc.**

Friction loss is created when water flows through pipes, valves, fittings and sprinklers or emitters. Supply lines and laterals should be sized to carry the flow needed without excess friction loss. Because friction loss is cumulative between the source and the nozzle, allowances have to be made to ensure that each nozzle has adequate pressure. Check pipe size pressure-loss tables when designing a water system.

Water heaters should be enclosed with an insulation jacket to reduce heat loss. Hot water pipes should be insulated to conserve energy. With the many pipe fittings and connections in a greenhouse, drips are inevitable. A faucet dripping at 60 drops per minute will waste 430 liters per month. If this water is heated with electricity, imagine what the loss will be!

**Power generation in the future**

The future of power generation and distribution is being researched. Photo voltaics, the direct conversion of sunlight to electricity, has been under development for many years. Solar panels are still quite expensive and economically feasible only in areas where power lines are expensive to install. Future greenhouses may have solar panels built into the roof that will power equipment and lights, with excess power fed into the utility company power grid.

Fuel cell technology, where hydrogen from natural gas, methane or gasoline is mixed with oxygen from the air to produce electricity, is also in the greenhouse industry's future. This technology increases efficiency and reduces pollution, compared to existing methods. Several large global industrial companies are testing units which in the near future would provide heat and electricity for a greenhouse operation.

**By: JW Bartok UC (sub-edited)**

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