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GROWING TOGETHER

Hazera
Growing Together

For more than a century, our experts have been walking hand in hand with our growers. Sharing with them our long legacy of experience and expertise, helping their plants and business thrive.

Our potential comes from within. Like with our seeds, through care, expertise and support. With our intensive research and our experts care and support, we help our growers deliver the most beautiful, tasteful and healthy crops.
Because everything starts and ends with growing together.

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SCRIPTURE

A lazy man's farm is the breeding ground for snakes. A patent on seeds is a patent on freedom. If you must pay for patented seeds, it's like being forced to buy your own freedom. A plant is like a self-willed man, out of whom we can obtain all which we desire, if we will only treat him his own way.

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Survival is currently the most often discussed subject by food producers. The question arises; what has happened to a free and fair trade and production system, without glitches like electrical and water supply shortages, dysfunctional export systems and other curtailments towards progress in food production? South Africa for many decades was on the forefront of quality produce, continuous flow towards markets and exports of note to many foreign destinations? Do we have to blame the 'wheel and deal' players in politics and foreign suppliers only? Napoleon Hill wrote a book, 'Think and grow rich'. It is possibly time as role-players in agriculture to look beyond the current barriers. New technologies like electronification, solarisation and a myriad of latest, well-researched and trialled technologies are available to producers. It is a question of good financial planning, utilizing every possible strategy in the business and moreover, obtaining finance from the right institution. Government can no more 'look the other way' when it comes to export taxes, no assistance towards energy, water, fuel and fertilizer costs in agriculture in the broad. Neighbouring state governments are all assisting producers with these important input expenses so their production levels can increase. We would like our government to look into these aspects and not fall behind their neighbours. With winter on hand, growers juggle their climate control, water supplies and possible greenhouse plant pests. We do our best to publish editorial content of relevance to the current season and hope this will stir feedback to the editor from producers who wish to know more on these subjects. Happy reading!

GROWING TOGETHER:
Driven by innovation, dedicated to quality

In South Africa's dynamic agricultural landscape, vegetable farmers require more than just seeds – they need trusted partners who combine cutting-edge innovation with a genuine commitment to their success. That's where we come in. With decades of expertise in breeding high-quality vegetable seeds, Hazera's mission goes beyond supplying exceptional genetics. It's about empowering farmers with solutions tailored to their unique challenges, ensuring sustainability, productivity, and profitability.

Innovation at the Core: Hazera's Advanced Solutions

Our commitment to agricultural innovation is unmatched. At the heart of Hazera's success is an investment of 17% of its annual turnover in research and development (R&D). This unwavering dedication is evident in Hazera's state-of-the-art greenhouses in the Netherlands, where advanced plant breeding technologies and genomic insights drive the creation of world-class seed varieties.

Hazera's breeding techniques focus on critical traits like higher yields, longer shelf life, and robust disease resistance. From understanding plant genetics to leveraging cutting-edge technology, we ensure that our varieties are optimized for performance and productivity in diverse environments, whether it's under the South African sun or in controlled greenhouses.

FRUIT QUALITY AND DISEASE RESISTANCE: THE NON-NEGOTIABLES

We know tomatoes

Tomato farming in South Africa is both exciting and challenging, with diverse climates and disease pressures. Hazera has risen to the challenge, offering varieties that excel in yield, quality, and resilience.

Our wide portfolio of tomatoes accommodates a range of segments for the grower's needs. Mazal and Zehim are strong varieties in the indeterminate segments that showcase Hazera's expertise. These tomatoes are prized for their resistance to TYLCV, TSWV - essential traits for South African growers

MAZAL

ZEHIM F1

Our R&D efforts here are focused on bringing you high quality varieties, with resistances to Fusarium 3 and Bacterial wilt.

Whether grown indoors or outdoors, Hazera's tomatoes deliver consistent, attractive fruits that meet market standards for shape, color, and uniformity.

Hazera's cucumber: Picking the benefits

At Hazera, we have a long tradition of cucumber breeding. As one of the first companies globally to develop short cucumbers, the Beit Alpha type, we have been innovating, improving and gradually expanding into more cucumber types.

Hazera's long cucumber varieties have set a new standard in the market. With over 15 years of experience in breeding cucumbers, we focus on fruit quality and a comprehensive disease resistance package.

PasioND and IslaND varieties already lead the way with resistance to CYSDV, CVYV, and Px. Upcoming launches, like ZiMMan,

IslaND

PasioND

promise to further revolutionize the sector with CGMMV resistance and excellent fruit-setting continuity.

Importantly, these varieties are designed to withstand South Africa's temperature fluctuations, ensuring consistent performance in any season.

Peppers: Multicolored quality

For pepper growers, Hazera offers varieties that combine high yield potential with outstanding fruit quality. Pegasos and Ragnar stand out for their vibrant red fruits and adaptability to indoor and outdoor cultivation. Both beautifully red – just like our sunsets in the bushveld.

Pegasos is known for its high yields, superior fruit shape, and color, while Ragnar's compact plants boast excellent heat tolerance and a protective leaf canopy.

We are continually enhancing our pepper varieties, with a focus on introducing nematode resistance in the near future – an invaluable trait for local farmers.

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The red spider mite - also known as the 'Two Spotted Spider Mite' - is one of those greenhouse pests that can be quite common on tomatoes grown under protection. Unfortunately it can also prove quite difficult to control.

RED SPIDER MITE on Tomatoes in the Greenhouse – Prevention is better than Cure!

Like the whitefly this is another fast-colonising pest usually found on protected crops. The red spider mite is a tiny wingless insect - up to about 1 mm long - with eight legs and a one-piece body. Young and adult mites feed on the leaves extracting sap and soft plant cells.

The first sign of a red spider mite infestation are either small spider webs - often high up on the plant - or white speckling on the upper surface of the leaves. As the attack progresses, they take on a bronzed appearance and may wither and die. Fine webbing is produced, strung between parts of the plant or under the leaves.

Using a magnifying glass the red spider mites and their eggs can be seen on the undersides of the leaves. In an unheated greenhouse the worst attacks occur from December to March, but red spider mites can be active year round. Serious damage to the plant is only done when population numbers dramatically increase resulting in leaf, flower and even fruit loss.

Of the dozens of different plant parasites which may plague tomatoes in a greenhouse, one of the most infamous, talked about, and feared is Tetranychida urtica — more commonly known as the two-spotted spider mite, or red spider mite. As luck would have it, these arachnids are also among the most common pests in indoor gardens. They are found everywhere. Native to Eurasia, they can now be found worldwide, particularly in controlled agriculture settings.

Although the mites' initial assault may seem innocuous, their tiny size and ability to reproduce very quickly compounds the issue. As the pests themselves are difficult to spot, a grower can easily miss the subtle signs of initial infestation if he or she does not closely inspect their greenhouse each day. A less vigilant grower might overlook these signs until leaves are already yellowing, dying and dropping off and the plants are covered in highways of webbing, not to mention hundreds or thousands of very mobile, very hungry mites.

So, we understand that spider mites are common, elusive, and destructive. How do we get rid of spider mites? Or better yet, how do we prevent spider mites from infiltrating our greenhouses in the first place? If you are diligent about prevention, eradication may not be necessary.

Mites are generally brought into the greenhouse by none other than the workers. Mites can ride in on clothing, hair, or any outdoor materials you bring in with you. For this reason, it is important to ensure that clothes, hands, hair, etc. are clean before entering the greenhouse – better still, to wear hygienic greenhouse apparel.

It is also important to know that mites can lie dormant when conditions are unfavourable, only to re-emerge when they think they may have a better chance at survival. When receiving any new seedlings, keep them in a separate quarantine area for the first week or two. This will keep any pests away from your greenhouse while you watch carefully for

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◀ Growing together from page 4

Beyond Seeds: A Commitment to Farmers' Success

Hazera doesn't just deliver superior genetics; it provides ongoing support to ensure farmers achieve the best results. From agrotechnical advice to hands-on assistance throughout the growing season, our after-sale service strengthens the bond between the company and our loyal customers.

This close partnership allows us to stay connected to the realities of South African farming, ensuring its solutions remain relevant and effective.

PEGASOS

RAGNAR

South African Growers

With a legacy of excellence and a future driven by innovation, Hazera Seeds is more than a seed supplier – we are partners in progress for South Africa's vegetable farmers. Whether you're cultivating tomatoes, cucumbers, or peppers, we are here to help you grow not just crops, but a thriving future.

LEAF SENSORS warn farmers when crops need water

Plant-based sensors that measure the thickness and electrical capacitance of leaves show great promise for telling farmers when to activate their irrigation systems, preventing both water waste and parched plants, according to researchers on the project.

Continuously monitoring plant "water stress" is particularly critical in arid regions and traditionally has been done by measuring soil moisture content or developing evapotranspiration models that calculate the sum of ground surface evaporation and plant transpiration.

But potential exists to increase water-use efficiency with new technology that more accurately detects when plants need to be watered.

For this study lead researcher Amin Afzal, a doctoral degree candidate in plant science, integrated into a leaf sensor the capability to simultaneously measure leaf thickness and leaf electrical capacitance, which has never been done before.

Researchers integrated the capability to simultaneously measure leaf thickness and leaf electrical capacitance into a leaf sensor to monitor water stress in plants.

The work was done on a tomato plant in a growth chamber with a constant temperature and 12-hour on/off photoperiod for 11 days.

The growth medium was a peat potting mixture, with water content measured by a soil-moisture sensor. The soil water content was maintained at a relatively high level for the first three days and allowed to dehydrate thereafter, over a period of eight days.

The researchers randomly chose six leaves that were exposed directly to light sources and mounted leaf sensors on them, avoiding the main veins and the edges. They then recorded measurements at five-minute intervals.

This research could lead to the development of a system in which leaf clip sensors will send precise information about plant moisture to a central unit in a field, which then communicates in real time with an irrigation system to water a crop.

The daily leaf-thickness variations were minor, with no significant day-to-day changes when soil moisture contents ranged from high to wilting point. Leaf-thickness changes were, however, more noticeable at soil-moisture levels below the wilting point, until leaf thickness stabilized during the final two days of the experiment, when moisture content reached 5 percent.

The electrical capacitance, which shows the ability of a leaf to store a charge, stayed roughly constant at a minimum value during dark periods and increased rapidly during light periods, implying that electrical capacitance was a reflection of photosynthetic activity.

The daily electrical-capacitance variations decreased when soil moisture was below the wilting point and completely ceased below the soil volumetric water content of 11 percent, suggesting that the effect of water stress on electrical capacitance was observed through its impact on photosynthesis.

"Leaf thickness is like a balloon — it swells by hydration and shrinks by water stress, or dehydration," Afzal said. "The mechanism behind the relationship between leaf electrical capacitance and water status is complex. Simply put; the leaf electrical capacitance changes in response to variation in plant water status and ambient light.

So, the analysis of leaf thickness and capacitance variations indicate plant water status — well-watered versus stressed."

The study is the latest in a line of research Afzal hopes will end in the development of a system in which leaf clip sensors will send precise information about plant moisture to a central unit in a field, which then communicates in real time with an

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irrigation system to water the crop.

He envisions an arrangement in which the sensors, central unit and irrigation system all will communicate without wires and the sensors can be powered wirelessly with batteries or solar cells.

"Ultimately, all of the details can be managed by a smart phone app," said Afzal, who studied electronics and computer programming at Isfahan University of Technology in Iran, where he earned a bachelor's degree in agricultural machinery engineering.

Two years ago, he led a team that won first place in the College of Agricultural Sciences' Ag Springboard contest, an entrepreneurial business-plan competition, and was awarded $7,500 to help develop the concept.

Growing up in Iran, Afzal knows water availability determines the fate of agriculture. In the last decade, the Zayandeh River in his home city of Isfahani has dried up, and many farmers no longer can plant their usual crops.

"Water is a big issue in our country," said Afzal. "That is a big motivation for my research."

Afzal's technology is very promising, noted Sjoerd Duiker, associate professor of soil management, Afzal's adviser and a member of the research team. Current methods to determine irrigation are crude, while Afzal's sensors work directly with the plant tissue.

"I believe these sensors could improve water-use efficiency considerably," Duiker added. "Water scarcity is already a huge geopolitical issue, with agriculture responsible for about 70 percent of world freshwater use. Improvements in water use efficiency will be essential."

In a follow-up study, Afzal has just finished evaluating leaf sensors on tomato plants in a greenhouse.

The results confirmed the outcomes of the just-published study. In his new research, he is developing an algorithm to translate the leaf thickness and capacitance variations to meaningful information about plant water status.

By: Jeff Mulhollem.

This positive research outcome could be of much value under South African conditions as well. Hopefully our greenhouse and open land producers will be able to acquire the product and apply it with great success in our ever-drier climate. Editor

This is such an important subject that we decided to publish it once more to the attention of our growers. (Ed.) 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.

IMPORTANCE OF IRRIGATION SCHEDULING
of greenhouse tomatoes and cucumbers

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 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).

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

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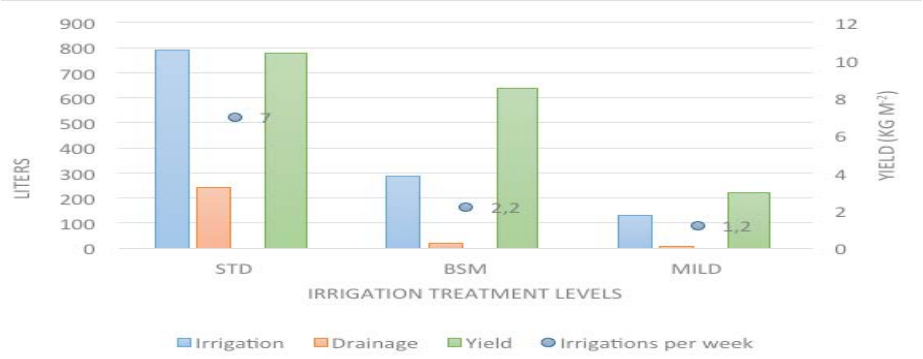

Figure 1

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

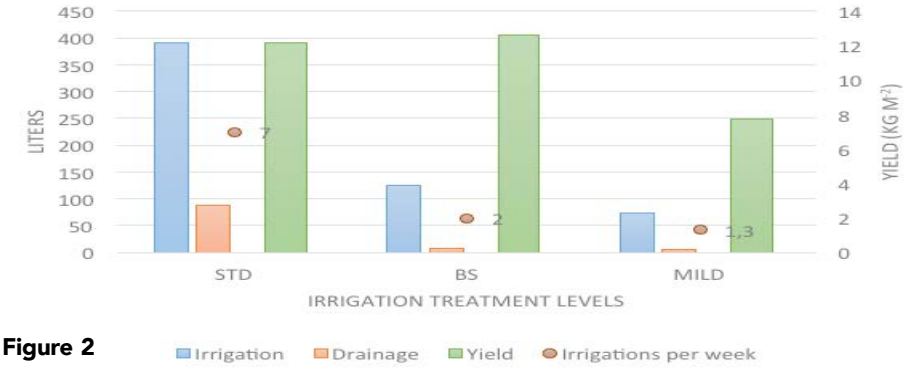

Figure 2

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

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 (Ph.D. Agric), Caryki Consulting CC (Director / Crop production specialist)
E-mail: rykievdw@gmail.com

◀ **Red spider mite from page 5**

their appearance on your new seedlings. Check daily for any signs of pests like those shown in the image and treat if necessary. In a perfect world, we would never have to treat for mites. Many of the greenhouse operators we talk to are currently fighting a mite population (again), or recently were. Most, if not all, have at one point or another.

Using Insecticides

There are many sprays marketed mainly or solely for the eradication of mites. Any insect population may contain individuals naturally resistant to many group code 12A insecticides. The resistant individuals can eventually dominate the insect population if these insecticides are used repeatedly and exclusively in programs. These resistant insects cannot be controlled by just any group code 12A insecticide.

Delay insecticide resistance

Avoid exclusive repeated use of insecticides from the same insect group code. Alternate or tank mix with products from different insecticide group codes. Integrate other control methods (chemical, cultural, biological) into insect control programs. For specific information on resistance management contact the registration holder of this product. An anti-resistance strategy in agricultural pests is very important. Use alternative products for the control of red spider mite and sucking pests in those areas where the cotton aphid has not yet developed resistance to organophosphates.

Importance of scouting

Make use of a scouting system and economic threshold values to determine when to commence application of insecticides for insect and mite control in tomatoes. Regular and a controlled scouting program will ensure the producer can act at the first sighting of red spider mite on his tomatoes and therefore save his entire crop.

Method when spraying

When spraying, make sure to wet the entire plant. Do not overdose by overlapping applications or by exceeding the recommended rate. Avoid spraying during the heat of the day or if foliage is wet. Allow 24 hours to expire between a application and overhead irrigation.

Ground application

Tractor sprayers for tomato application:


Red spider mite took over this tomato crop. Be agile and spray early.

Apply using different spray volumes depending on plant size and application method. Ensure thorough wetting of the plants. For plants up to 600 mm use up to 500 l/ha water. For plants higher than 600 mm use up to 1 500 l/ha water.

Mist blowers and low volume spray applications for tomatoes: Complete coverage of the plant is vital. It is essential to apply the same volume per hectare as would be the case when high volume spray equipment is used, notwithstanding the volume of water per hectare applied.

It cannot be reiterated enough that prevention is better than cure. Also, should it be necessary to use insecticides to save the crop, especially in a controlled environment like a greenhouse, the assistants should be protected against the remotest form of poisoning.

Source: Pest control suppliers

CURRENT IMPORTANCE OF FOOD TRACEABILITY – KEEP CONSUMERS SATISFIED

In this era, the journey of our food from farm to fork is increasingly scrutinized. Understanding food traceability has never been more important. This is not just about knowing the origin of hydroponics produces but also about ensuring quality, safety, and sustainability throughout its lifecycle.

What does food traceability mean for the producer's produce? Revolutionizing product traceability is key to ensuring that our food is ethically and sustainably produced.

This editorial discusses the role of produce traceability in controlled environment agriculture (CEA) and beyond.

What is Food Traceability?
Food traceability, in simple terms, is the ability to track the journey of food products. These products are tracked from their origin through each production stage, processing, and distribution until they reach the consumer.

It's like having a detailed travel diary for your food, noting every stop and process it goes through along the way.

Food traceability systems are built on several essential elements and technologies:
Identification and Labeling: Barcodes, QR codes, or RFID tags used to identify food products and batches.

Data Capture Devices: Barcode scanners, RFID readers, and IoT sensors record crucial data throughout the supply chain.

Database Systems: Centralized repositories store and manage the collected information.

Traceability Software: Specialized software for integrating data, analysis, and reporting.

Internet of Things (IoT): IoT sensors monitor conditions like temperature and humidity in real-time.

Blockchain Technology: Provides a secure, immutable record of the product's journey.

B**ig Data and Analytics:** Analyze large datasets for trends and supply chain optimization.

Cloud Computing: Offers scalable storage and data processing capabilities.

GPS and Geolocation: Track real-time movement of products during transportation.

Compliance Management Tools: Ensure adherence to regulatory standards.

Together, these components ensure the food supply chain's safety, quality, and efficiency, enhancing transparency and consumer trust.

Significance of Traceability

Produce traceability plays a critical role in ensuring the safety and quality of fresh foods. Tracking the journey of food products lets us identify and isolate contamination, spoilage, or quality degradation.

This process ensures that only safe and high-quality produce reaches the market. It also facilitates adherence to health and safety standards throughout the supply chain, enhancing quality and consumer safety.

On the other end of food recalls, product traceability is integral in managing recalls effectively. If there is a problem, traceability systems enable precise identification of affected products. We can then rapidly remove problem produce from the supply chain. This swift response mitigates health risks and minimizes waste by preventing the recall of unaffected products.

Moreover, produce traceability fosters transparency. It provides consumers with detailed information about the origin and handling of their food. Transparency builds consumer trust. As people are more confident in the safety and quality of their food when they know its journey and history.

Consumers and the Market
The importance of food traceability in the modern food supply chain is multifaceted:

Sustainable Practices: Traceability can track the environmental impact of food production. It can help consumers and businesses make more eco-friendly choices. These choices are especially important in promoting sustainable practices in the food industry.

Consumer Trust: In today's market, consumers are increasingly conscious about what they eat. Traceability provides transparency, allowing consumers to know where their food comes from and how it's produced. This transparency builds trust and confidence in food products.

Safety and Quality Assurance:
Traceability helps identify and address problems in the food supply chain. This rapid response is crucial for preventing foodborne illnesses and maintaining high food quality standards.

Efficient Recall Management: In food

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safety issues, traceability enables faster, more accurate product recalls. This efficiency minimizes public health risks and reduces waste of non-affected products.

Regulatory Compliance: Many countries have strict regulations about food traceability. Traceability helps businesses comply with legal requirements, avoid penalties, and ensure market access.

Market Insights: Traceability data offers insights into consumer preferences and market trends. This information helps businesses optimize supply chains and develop products that meet evolving market demands.

In essence, food traceability is not just about keeping a record. It's critical for ensuring food safety, building trust, compliance, and promoting sustainability.

Food Traceability in Controlled Environment Agriculture (Greenhouses)
In vertical farming and hydroponic systems, traceability is vital. It's key to monitoring plant growth conditions and nutrient levels. By tracking each plant's journey, these systems ensure optimal growth conditions and high-quality yield. Traceability here includes monitoring variables like light, temperature, water quality, and nutrients. Overall, this data can provide a comprehensive view of the entire cultivation process.

One of the benefits of hydroponics and other tech-based growing systems is improved traceability. Because CEA tends to be high-tech, such farms are already monitored and manipulated for optimal yield. The only additional step is to keep records of these conditions and tie those records to individual plants. This is good for consumers and can help growers optimize temperature, lighting, and other factors for each plant type.

Technological Advancements
Today, cutting-edge technologies are enhancing traceability in the AgTech space. Blockchain in agriculture is revolutionizing food traceability. It's creating a secure, transparent ledger for supply chain transactions. This enhances traceability and builds trust by allowing authentication of a product's entire history. It's essential for verifying organic produce or confirming its origin.

AI and big data analytics transform the management of vast supply chain data sets. AI predicts disruptions and optimizes logistics. Meanwhile, big data analytics offers insights into consumer behaviour. This technology is crucial for quality control and aligning traceability with market demands.

IoT technology enhances real-time monitoring in the supply chain. It uses sensors to track critical conditions for perishable goods. This ensures immediate responses to deviations, maintaining product integrity. Integrating IoT with blockchain and AI creates an efficient, reliable framework. It's a boost for food traceability, significantly improving food safety and quality.

Produce Traceability Initiative
There's a global movement currently underway toward greater traceability in the produce space. The Produce Traceability Initiative is attempting to voluntarily spread traceability through the industry. They aim to help growers, distributors, and other stakeholders effectively track and trace produce. They're also working to develop a standardized approach to traceability systems.

Ethical considerations
Beyond regulatory concerns, traceability has sustainability and ethical implications. Produce traceability tracks efficient use of water and energy and supports sustainable farming. It also helps identify areas to reduce environmental impact, like reducing emissions and waste.

Ethically, traceability can help ensure fair labour practices in the food supply chain. It provides transparency about food origins and working conditions. This means consumers can use their purchases to combat issues like labour exploitation.

Source: Excerpt from Eden Green news

MANAGING WATER QUALITY FOR CROP PRODUCTION

Irrigation water quality is a critical aspect of greenhouse crop production. In South Africa, effluent in rivers and dams causes poor quality and even possibility of bad substances fo human onsumption. 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. To determine this, water must be tested at a laboratory that is equipped to test water for agricultural irrigation purposes.

Quality water a priority

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.

Using reclaimed water?

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.

Use 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.

Analysis

Before selecting a filter, a water analysis should be done. The type and quantity of solids should be determined, taking in consideration seasonal changes such as algae growth or spring runoff. To determine the type of filter, consider the flow rate needed to supply the irrigation system and the level of filtration needed.

Screen or disk filters work well for most applications. A 200-mesh filter is usually recommended for micro-irrigation. The filter should be sized so that the flow rate is large enough to handle the peak demand.

Maintenance of a filter is important. Installing pressure gauges on both sides of the filter will indicate when it is becoming clogged. When the pressure variation between the two gauges exceeds about 10% the filter should be cleaned.

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".

A greenhouse water study found that pH in the range of 7-8 is common in most water sources. These higher pH levels are typically not a problem unless the alkalinity exceeds the acceptable range. High pH/high alkalinity water is common in Berkshire County and sometimes is found in other parts of the state.

Potential 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. This situation is typical for many growers using municipal water in Massachusetts, including water originating from the Quabbin Reservoir.

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.

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Potential beneficial effects on nutrition
Water with moderate levels of alkalinity (30-60 ppm) can be an important source of Ca and Mg for some greenhouse operators. With the exception of a few fertilizers, many water-soluble fertilizers do not supply Ca and Mg. Also, the Ca and Mg from limestone may be inadequate for some plants. Moderately alkaline water can beneficial as a source of extra Ca and Mg for crops prone to Ca and Mg deficiencies.

Acid Type
The acids commonly available to growers include phosphoric, sulfuric, nitric, and citric. Table 3 lists criteria for choosing the right acid for your situation: relative safety, neutralizing power, cost, and nutrient content. One of the most widely used acids is sulfuric acid; however, this is one of the most hazardous acids to use. For low amounts of alkalinity removal, phosphoric acid may be a better option.

Safety First
Acids are hazardous chemicals. When concentrated acids are mixed with water, a tremendous amount of heat is generated (which can even distort or melt plastic). Improper mixing can result in bodily injury.

Proper Mixing
Use acid-resistant containers for containing the acidic stock solution. Heavy duty polyethylene trash cans are adequate.

Always mix acid to water. Fill the stock container to about half the final volume you wish to mix with water. (Note: Since this is a pilot run, you do not want to make up a full amount of acidified stock solution because you may wish to adjust the amount of acid or to add fertilizer to the stock solution later.) Measure the acid carefully using a good measuring vessel. Then add acid to water, slowly and carefully to the center of the water surface.

Calcium and Magnesium
Calcium and magnesium may need to be removed from hard water to eliminate salt deposits left on foliage by overhead irrigation. This can be achieved by water softening; that is, replacing the calcium and magnesium with potassium.

Note that the usual water softening unit uses sodium, not potassium. High levels of sodium may be harmful to plants and a softening unit that uses potassium should be used instead. Total salt content of the water is not changed and the potassium is used by the plants. Over fertilization with potassium may occur if the water is very hard. The potassium chloride in the softening unit must be recharged.

used for blending. Rainwater has a natural pH of about 5.6 and a very low mineral content. Acidic rainwater with a pH in the range of 4.0-5.0 is acceptable for irrigation; it's poorly buffered and will have little effect on growing medium pH. Water with a pH below 4.0 should not be used as it may injure seedlings and young transplants. 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.

Checklist: Water Quality for Crop Production
Have water tested at a laboratory that is equipped to test water for irrigation purposes. Irrigation water tests should always include pH and alkalinity.

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.

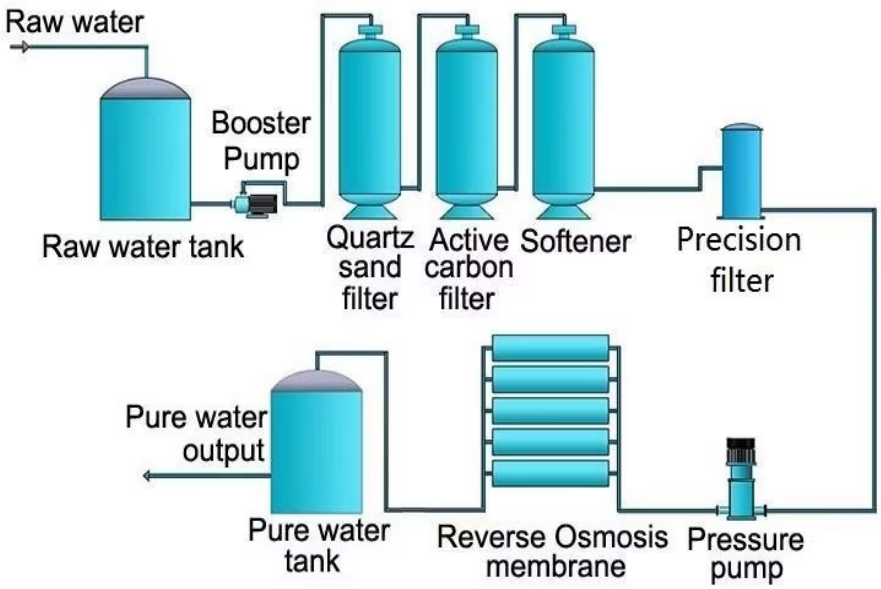
Use filtration to remove suspended solids from water to prevent clogging of piping, valves, nozzles and emitters in an irrigation system. Suspended solids include sand, soil, leaves, organic matter, algae and weeds.


(photo: Tina Smith, UMass Ext)

Water pH may need to be adjusted before being used for mixing some pesticides, floral preservatives, and growth regulators. Source: US Mass, et al.

Agriculture Irrigation Used Reverse Osmosis Water Treatment
Cut flowers growing in crates with drip tape, being irrigated with water from a private well.

95% purification efficiency
Recently, the partners involved in the realization of a PACAS installation, at the sewage treatment plant Nieuwe Waterweg (Holland), met. The installation will ensure that more than 300 horticulturists, representing more than 1,000 hectares, have their water purified of crop protection agents centrally.



CITRUS PRODUCTION under coloured shade nets – important facts

In this editorial some important and available information on shade nets is combined in an attempt to provide citrus producers some background on the use of shade nets in a South African context.

Shade netting could provide significant solutions to fruit-quality-related problems and increase producer competences. Production is somewhat higher than under bright ones (white and transparent) shade net.

The use of non-permanent drape nets is also popular among Israeli citrus producers for protecting fruit against hailstorms in late autumn and early winter (personal correspondence, Dr. Avi Sadka), as well as in California and Australia to restrict cross-pollination and development of seeds in mandarin cultivars, specifically.

The cost comparison between permanent and drape nets favours the use of drape nets, as the lifetime of the nets is longer, with no costs for poles, cables and so forth.

However, there are some worrying questions on the coverage and efficacy of medium and full-cover foliar fungicide and insecticide sprays, as well as the effects of drape nets on fruit set, considering that Foliar GA3 sprays may also be impacted.

Wind damage due to abrasion between drape nets and outside fruit could also reduce the benefits under drape nets, if they remain on the trees after petal fall.

Although the use of shade nets is rapidly expanding in the various South Africa citrus production areas, many critical research questions on the effects of shade nets on tree physiology and fruit quality are unanswered and require urgent attention.

Also, many practical issues regarding production logistics and management of orchards under nets are neglected in some instances. Visits to various citrus producers making use of shade nets to find out their first-hand experiences on the effects of shade nets on citrus production.

EXPERIENCES OF PRODUCERS

A producer in the Northern cape planted 35 hectares of 'Nadorcott' mandarin trees a few years ago – 12.5 ha under permanent 20% white nets and 12.5 ha outside.

During spring and summer, they struggled with very strong winds and were forced to consider erecting permanent netting structures over some of their new plantings of high-value cultivars.

Young trees under nets became almost double in size, compared to those outside.

CONCLUSION

What to plant, where, and how to optimally apply which technologies will be of critical importance.

To avoid exposure to the future threats of climate change and increased competition in the markets, producers should reconsider. Shade nets could provide significant benefits against these threats, but much practical information and answers to critical research.

A co-funded project between the Department of Science and Technology (DST) and Citrus Research International (CRI) in the Research for Citrus Exports programme is underway.

Source: Horticultural Science, University of Stellenbosch

THE FUTURE OF GREENHOUSES - VIEWPOINT BY WUR HORTICULTUREHORTICULTURE

What will a greenhouse look like in 2040? Which cultivation methods will be used, how will energy be stored and what will the greenhouse structure look like? Wageningen University & Research, BU Greenhouse Horticulture is investigating these questions on behalf of the innovation programme Kas als Energiebron.

Researcher Ilias Tsafaras: "We are trying to predict the challenges for the future and at the same time look for solutions for them."

Pest control with help from space (CORDIS)

Kas als Energiebron (Greenhouse as an Energy Source) is a program that stimulates energy saving and the use of sustainable energy in greenhouse horticulture. It is a joint initiative of Greenhouse Horticulture Netherlands and the Ministry of Agriculture, Fisheries, Food Security and Nature. Kas als Energiebron asked WUR, Delphy, and Botany to create a concept design for a Dutch greenhouse in 2040.

Tsafaras: "To arrive at a design, we are organizing several workshop series. The first workshops were with scientists from different disciplines. We brainstormed with them about important themes. There was a lot of discussion about cultivation systems: how can robotization help with a labour-intensive crop like cucumber, for example?

Does the crop drive to the robot? Or does the crop need to be adjusted? We will have workshops with companies in the coming months. These companies also have different areas of expertise."

Based on all the input, WUR, Delphy, and Botany will create a concept design for Greenhouse 2040. This design will be based on aspects such as: not using fossil fuels, fitting in with the changing climate, and no emissions. Furthermore, only techniques may be used in the greenhouse that will be commercially available in horticulture or another sector within the next few years: that was a condition of Kas als Energiebron.

Distant management with AI driven systems

Tsafaras: "There is a chance that we will create more designs for different greenhouses: one type for one cultivation system. It makes quite a difference whether you design a greenhouse for a crop that grows in the open ground or on a substrate. Or whether the crop is harvested several times a year, or just once. Or whether it is a lighted crop, or not." **Wageningen University & Research**

HEATING PROCESSES IN GREENHOUSES DURING WINTER

Although harsh temperatures are currently experienced, often people ask the question of what effect extra cold temperatures have on undercover farming.

Generally, in South Africa the only effect is (where produce are hydroponically grown, for a start) that of higher production input cost because of heating. With electricity and gas prices going through the ceiling, producers must bite the bullet to keep production at an even keel.

Seeing fresh produce on the grocery store shelves throughout winter is nothing new – our greenhouse producers have been making it happen for years. What is new, however, is the increase in technical applications in both structure, inventions like screen systems and of course, electronic devices.

Some farmers use insulated tanks to pump outflow water from the greenhouse to the tank as it maintains a much higher temperature as that in the reservoir. This means the stored water needs less energy to be heated up to the required temperature to heat the greenhouses.

The morphology of roots of plants grown in greenhouses is as such that it does not produce well if temperature at the roots decreases below 16-18°C.

This has been tested and confirmed over and over. Therefore it is imperative to heat the surroundings of the roots to an amiable level to expect flourishing of the plant and thus it will offer optimal production during winter.

In winter rainfall areas like the Western, Southern and Eastern Cape, greenhouse structures provide farmers with an attractive environment protected from snow, frost, wind, and excessive rain, and allow the grower to control the humidity, moisture, and temperature.

Undercover farming
The first known greenhouses were designed by the Roman Emperor Tiberius (42 BC – 37 AD), explains John Perlin, author of Let it Shine: The 6,000 Year History of Solar Energy.

Tiberius had "a penchant for cucumbers," says Perlin, and had special carts of soil built to be wheeled into the sun and covered to retain the heat, keeping his cucumber plants producing through winter. Although the use of glass in winter agriculture more or less disappeared through the Middle Ages, interest in covered growing spaces rebounded around the 15th Century.

This type of growing, though effective, was severely labour intensive. And covering large spaces with glass panes was simply beyond the budget of most small farmers. So although many elaborate greenhouses were built from the 15th Century to the early 20th Century, most weren't within reach of the average grower.

Everything about winter production changed when polyethylene plastic came along. By the 1960s plastic for greenhouses was widely available. Labour went down, so the profitability of winter farming went up. However, while these large plastic structures solved certain problems, they created new ones.

The most popular greenhouse heating system still is warm water pipes running below the plants in greenhouses. In high greenhouses these also are used for trolley's to inspect or pick crops.

Under Cover Crops
What most greenhouses do if left unmanaged is not create a perfect microclimate; rather they create a desert. They concentrate heat while preventing moisture from penetrating, so although this covering helps protect from wind, snow, and excess rain, irrigation becomes essential.

Once you bring water into these houses, however, you create humidity, excesses of which can lead to fungal diseases on your crops. Sealing out the wind also seals out the airflow, further adding to disease susceptibility, damaging pollination, and encouraging pest problems like aphids.

Then, of course, you still have to worry about extreme cold killing your plants. Add to these problems the fairly prohibitive cost of building the structure itself, and it just wasn't worth it for most farmers to expend the energy to grow food in winter.

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A typical gas heating installation with insulated tank to keep the outflow water at its temperature to only use minimal energy to heat to the required temperature. At left is an enclosed reservoir under roof.

Greenhouse boom

Then, late in the last century, things started to change. Growers persisted - some annually visit Holland, Spain and other countries to gain first-hand knowledge, paving the way for a dramatic increase in farmers growing under cover.

Designs were revised, and technology rose to meet the needs of winter farmers. Now, protected culture is a much different, and more approachable, story.

The improvements in the flexible plastic itself, sometimes called greenhouse film, has likewise been crucial to the shift.

Not only is the plastic now made to resist degradation from ultraviolet radiation, but many films now contain anti-condensation coatings that help spread the water out, encouraging better light penetration while preventing drips.

Manufacturers have also started to manipulate the film technology to take better advantage of the greenhouse effect, allowing more light to come in but less heat to escape.Latest designs in plastic offer extra-long life under average conditions.

Electronic management

The Internet of Things is currently the major management tool that enables the greenhouse operator to remotely monitor elements such as humidity and temperature from their homes or via cell phones. Ultimately, farming is a practice limited by available sunlight and heat.

Innovations like those described above however, stretch those resources for farmers, opening up more opportunities for income, but also for levelling out the workload so as not to be so dependent on summer production. That is all the more reason for farming undercover in South Africa. **Ed**

Cucumber seedlings ready to be transplanted.

SEEDLINGS - Growing your own or have a professional grow for you?

Whether a greenhouse grower should grow their own seedlings or purchase them from a professional depends on several factors including the scale of their operation, the desired plant varieties, their level of gardening expertise, available time, and budget.

For smaller operations or growers with limited time, buying seedlings from a professional can be more efficient, while larger scale growers often benefit from raising their own seedlings for greater control and potential cost savings; however, even large-scale growers might still purchase specific varieties or specialty seedlings from professional nurseries depending on their needs.

Growing own seedlings

The main advantage for the smaller greenhouse operator is the cost-effective aspect. Starting seeds can be significantly cheaper than buying pre-grown seedlings, especially when growing large quantities.

Variety

You can choose precisely the varieties you want to grow, which might not be readily available from nurseries. Adjust growing conditions to match your specific needs, like light and nutrient requirements.

The process of nurturing seedlings from seed can be rewarding for many gardeners or smaller greenhouse farmers.

Buying seedlings from a professional

Growing seedlings takes time and expertise, which can be especially valuable for busy growers. Professional nurseries often have specialized knowledge and facilities to produce healthy, high-quality seedlings.

Access to unique varieties:

Specialty or hard-to-find plant varieties may only be available from professional growers. Experienced growers can minimize the risk of seedling diseases and other issues.

Greenhouse size

Larger greenhouses might justify the time investment in raising their own seedlings, while smaller spaces may benefit from purchasing transplants. Some plants are easier to start from seed than others, and certain varieties might be readily available from nurseries.

Local availability

Check what options are available from local nurseries and consider the quality of their transplant seedlings after germination, wait until they develop their first set of true leaves, then gently lift them from the seed starting tray using a small tool like a pencil or spoon, ensuring to handle them by the leaves.

Carefully place them into individual pots with fresh potting mix, burying the stem slightly to the same level as before, and then water thoroughly; make sure to provide proper light and temperature conditions for continued growth.

Wait for true leaves

Don't transplant seedlings until they have developed their first set of true leaves, which appear after the initial cotyledon leaves. Fill individual pots with a suitable potting mix, leaving enough space at the top for watering.

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Gently loosen the soil around each seedling in the seed tray using a small tool to avoid damaging the roots.

Lift by leaves:
Carefully lift the seedling by its leaves, not the stem, to remove it from the tray. Make holes in new pots. Create small holes in the potting mix of the new pots using your finger or a pencil.

Plant seedlings:
Place the seedling in the hole, ensuring the soil level is the same as before, and gently firm the soil around the roots. Water the newly transplanted seedling well to settle the soil and reduce transplant shock.

Important Handle with care: Be very gentle when handling seedlings as they can be fragile. Minimize root disturbance: Try to keep as much soil around the roots as possible when transplanting.

Light and temperature: Place the transplanted seedlings in a location with adequate light and appropriate temperature. seedlings.

Commercial greenhouse farmers
There are a few outstanding seedling growers in South Africa that will gladly assist with advice.

The producer's need for his market, quantity produce for markets and growing requirements for maximum quality and quantity are first and foremost subjects to discuss.

The seedling grower needs to be advised when seedlings will be required

and quantities to manage his infrastructure to the requirements of his client.

Growers with large greenhouses that need to feed their markets throughout the year plant seedlings in a predicted time to supply farmers.

It is of importance the producers and seedling growers have communication throughout the year.

Mostly seedling growers will supply a small batch of new varieties to a producer to test the viability of a new product, which he then can approach his market with to keep them ahead of the pack in fresh produce marketing. **JS**

Professionally grown seedlings offer an even plant stand.










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