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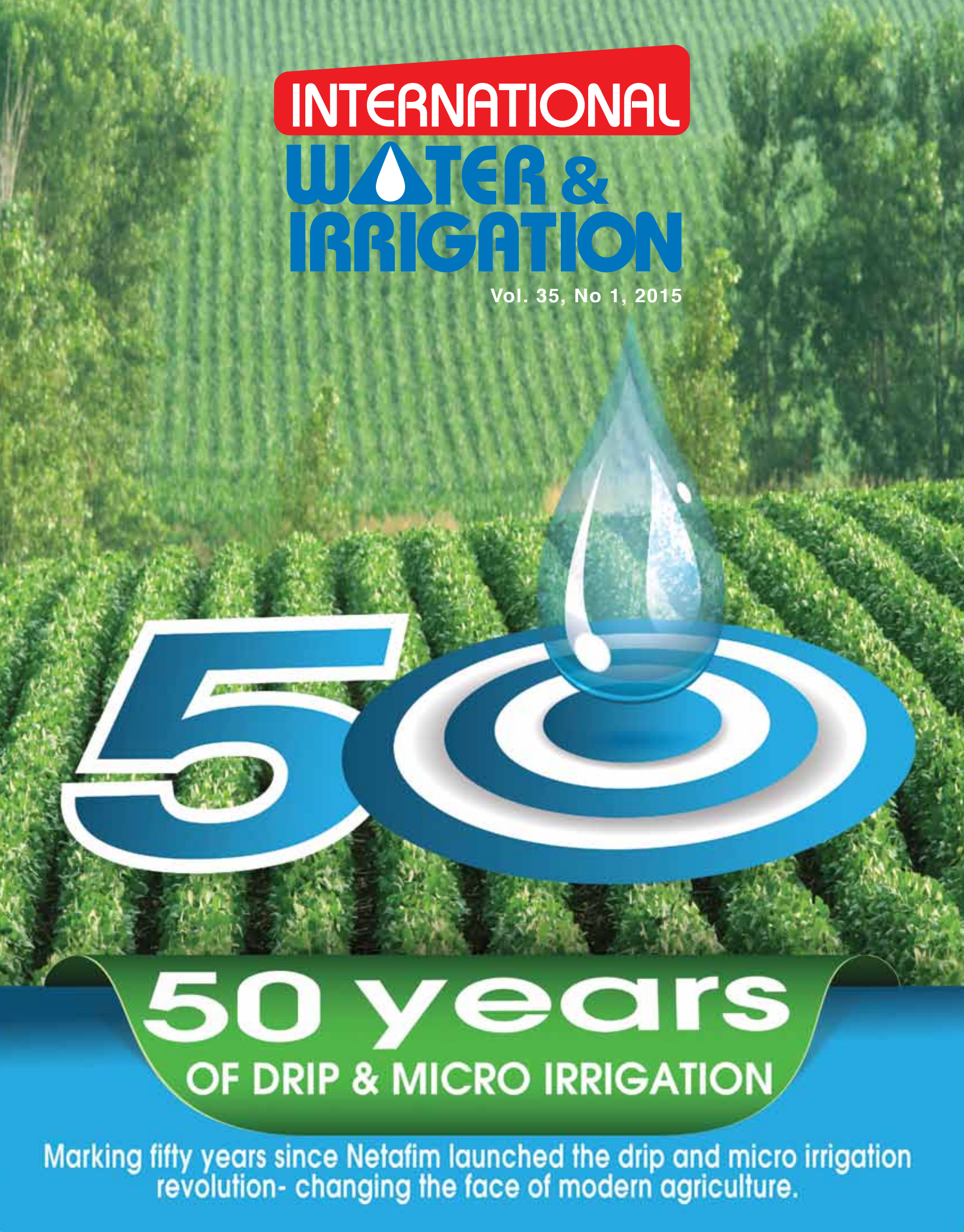

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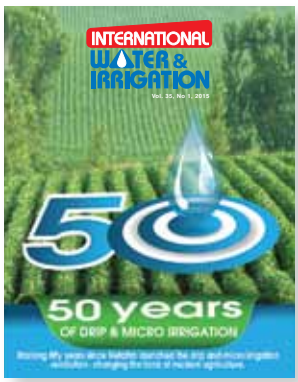

ON THE COVER
50 years of Drip and Micro Irrigation
International water & Irrigation,
wish to congratulate the International drip irrigation industry, for helping the world meet the challenges of shortages in food and water and a more sustainable future

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Drip irrigation goes Gold
In this article we provide celebrate the Fiftieth anniversary of the launch of the drip irrigation revolution and recall some of the people who made it possible

Dry matter and macro-nutrient accumulation in fruits of Conilon coffee with different ripening cycles
In this article we explain how growers can successfully gauge and supplement levels of dry matter and macro-nutrients when cultivating coffee

Estimating soil moisture status in peach tree orchards through a crop water stress index
In this article, we provide an accurate assessment of how growers are turning to the use of thermal imaging in calculating crop water stress index


50
YEARS
OF SHAPING
THE FUTURE

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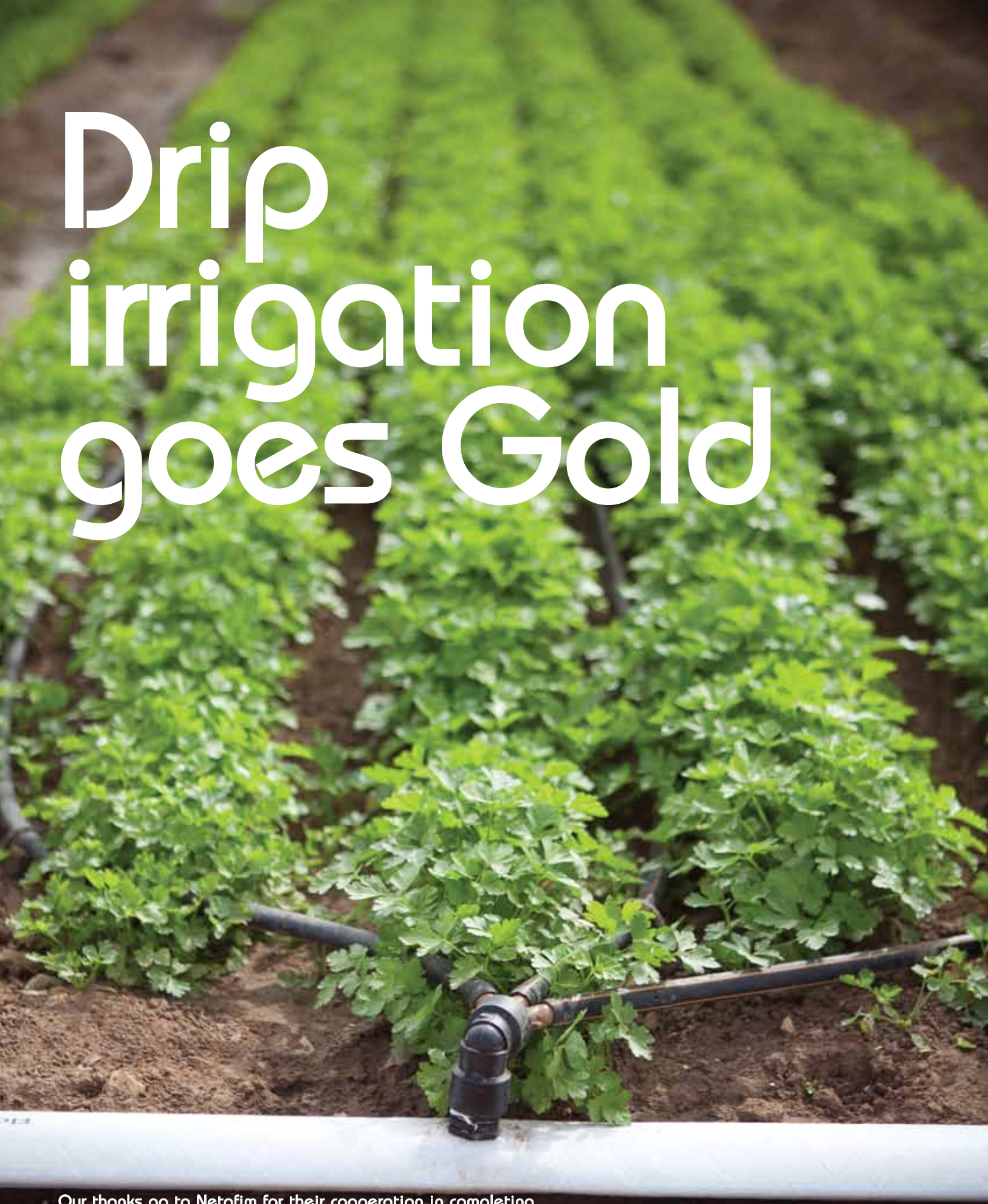
Drip irrigation goes Gold



Our thanks go to Netafim for their cooperation in completing this article by providing the above illustration

Drip Irrigation by PlastProject

Fifty years ago, in 1965, Netafim, owned by Kibbutz Hatzerim in the Negev of Israel registered their first patent relating to drip irrigation. An innovation, which would evolve and grow and, in the process, change the face of agriculture across the globe.
Although some forms of Irrigation have been practiced for centuries, only from the beginning of the 20th century, new levels of sophistication were developed thanks to the advent of deep well turbine pumps, combustion engines, rural electrification followed later by the development of open field, sprinkler and most recently drip irrigation systems.

Since its foundation in 1948, Israel has placed great emphasis on maximizing its water supply. David Ben Gurion, Israel's founding father, made it a very clear goal that he would see the country "make the desert bloom". Ben Gurion's dream mission which rapidly became one of its foremost challenges of the new nation, in the firm belief that, if the goal was achieved, it would make Israel one of the major contributors to the world of modern agriculture.

Drip Irrigation by Azud

In the early nineteen fifties, a rapidly growing population, meaning increased demand for food with water being traditionally scarce in the hot desert climate meant that a solution in how to provide efficient irrigation solutions. Solutions needed to be found, and rapidly, as growers simply did not have anywhere need the water resources available, especially to use the traditional methods of irrigation, which were commonly in use in those days, such as furrow irrigation, which was especially wasteful.

Fifty years ago, in 1965, Netafim, owned by Kibbutz Hatzerim in the Negev of Israel registered their first patent relating to drip irrigation

After feverish research, carried out over a number of years, the first commercially produced irrigation dripper rolled off the production line at Netafim's factory on Kibbutz Hatzerim. Ben Gurion's vision began to become a reality, eventually spreading throughout the World.
Now, fifty years have gone by since drip irrigation technologies were introduced, initially in the arid Negev in Southern Israel.

During its early years, among the Israeli farming community drip irrigation was regarded solely as a means of water conversation, however, as techniques evolved on how making maximum use of the new innovation, the practice of drip irrigation, if practiced with any level of efficiency,

Drip irrigation

was observed to have a dramatic effect not only on yields but also quality.

This gradual realization saw the use of drip irrigation to be used not just in the cultivation of intensive crops, including flowers, vegetables, but also in " field crops" as well as in fruit orchards.

One of the first places where drip irrigation was introduced was in the traditional water parched state of California, where the first tests in its feasibility took place during the late Sixties.

According to reports, the Californian farming community failed to rapidly grasp the advantages of drip irrigation, meaning that twenty years later, only 5% of irrigated acres in California were using drip irrigation. Their general reluctance to invest in the initial switch to drip irrigation, was both its cost and the risk that they would not necessarily see a return on their investment.

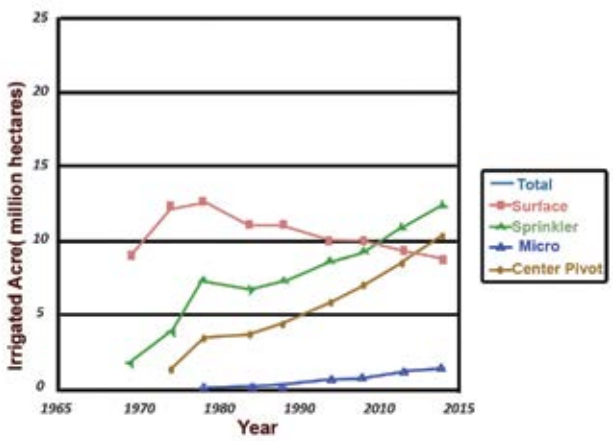


Figure One: *Trends in irrigated acreage in the United States from 1965 till 2015*

By the mid-1970s, there were around 60,000 acres in California under drip irrigation, by the early 1980s, there were 300,000, and by the middle of the decade another 50,000 acres had been handed.

The reason for the rapid upsurge in interest during the years was the catastrophic drought of 1977, where growers were forced to grasp the reality that water would not always be available to them in unlimited quantities, and the only way to extract the maximum value from every drop was to embrace the tremendous advantages of drip irrigation.

In the United States, from that particular turning point,

Table One: Efficiency levels for different types of irrigation systems

Type of System	Efficiency (%)
Drip	90
Micro-Sprinkler	80
Permanent Sprinkler	75
Moving Sprinkler (Standard)	80
Movable Sprinkler (Rapid Coupling)	70
Movable Sprinkler (Other Variations)	65
Flood Irrigation (Piped Supply)	70
Flood Irrigation (Channel Supply)	60

Drip Irrigation By Netafim

and understanding of the benefits of drip irrigation spread rapidly, steadily making its way around the world.
Over the last twenty years, the presence of drip irrigation has become almost a default factor for modern cultivators, with areas under drip and other forms of "micro" irrigation methods having increased more than sixfold, from around four million acres to close to a conservatively estimated thirty million.

The above illustration was provided by Metzerplas to whom we extend our thank

When the pioneers of drip irrigation got together and took upon themselves the mission of "making the desert bloom, they could have had little inkling of how the concept they developed would have had such a dramatic influence on agriculture , at every level and throughout the world

Among the countries of the world where the most dramatic gains in the use of drip irrigation have taken place are China and India, where the areas under drip irrigation have grown more than 100 fold over the last two decades. India now leads the world with them quantity of land under irrigation with around five million acres.
Particularly over the last ten to fifteen years, the practice of drip irrigation has been increasingly precise, driven by the awareness that water is becoming increasingly scarce as the global population increases. This has driven a more sophisticated use of computers and controls on new irrigation systems, while sensors play a big part in this new technology.
As the practice of the drip irrigation became more

Table Two: Estimated annual percentage savings in adopting drip irrigation

Marginal Cost of Water (per cubic meter)	Marginal Cost of Water per Acre	Value of Annual Water Savings through using Drip Irrigation ($millions)	Value of Annual Water Savings through using Drip Irrigation (%)
$2.50	$200 (80 acres)	$30	15%
$2.40	$360 (150 acres)	$60	16.67%
$2.30	$506 (225 acres)	$90	17.8%

Table Three: Estimated annual percentage increase in farm income through adopting drip irrigation

Estimated overall Yield effect of Drip Irrigation (per acre)	Increase in income from using Drip Irrigation (per acre)	Value of Annual Water Savings through using Drip Irrigation ($millions)	Value of Annual Water Savings through using Drip Irrigation (%)
5%	$185 (80 acres)	$30	15%
15%	$360 (150 acres)	$60	16.67%
25%	$506 (225 acres)	$90	17.8%

widespread what once was once an unusual occurrence has become commonplace, and that is the use of satellites as a means of providing sensor platforms, so that farmers in certain geographical region can be provided with an up-to-date situation of their water needs on a daily basis and operate their irrigation system remotely.

While this can sound grandiose on a semi - macro scale this practice is proving to be highly cost-effective while user friendly and demanding minimum time requirements. More than half a century since the pioneers of Netafim first produced the original integral dripper, which in itself generated an industry of ancillary products and equipment without which no irrigation project, no matter how large or small, can function in any way efficiently. These auxiliary products include sophisticated filtration systems, pressure regulators, water meters, air release valves and countless other components that go into making a complete irrigation system.

As the world population continues to grow, increasing efficiency in Irrigation will be needed to provide high quality food, whilst taking the maximum advantage from water supplies by minimizing wastage and bringing the exact quantities of water to the plant, and within an exact time scale.

When the pioneers of drip irrigation got together and took upon themselves the mission of " making the desert bloom, they could have had little inkling of how the concept they developed would have had such a dramatic influence on agriculture , at every level and throughout the world. ■

Thanks to Azud Irrigation for providing the above illustration

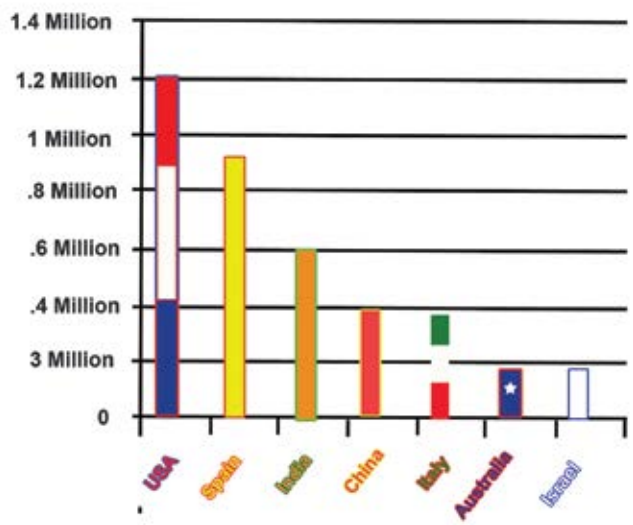


Figure Two: *Areas under irrigation at the end of 2010 (Millions of Hectares)*

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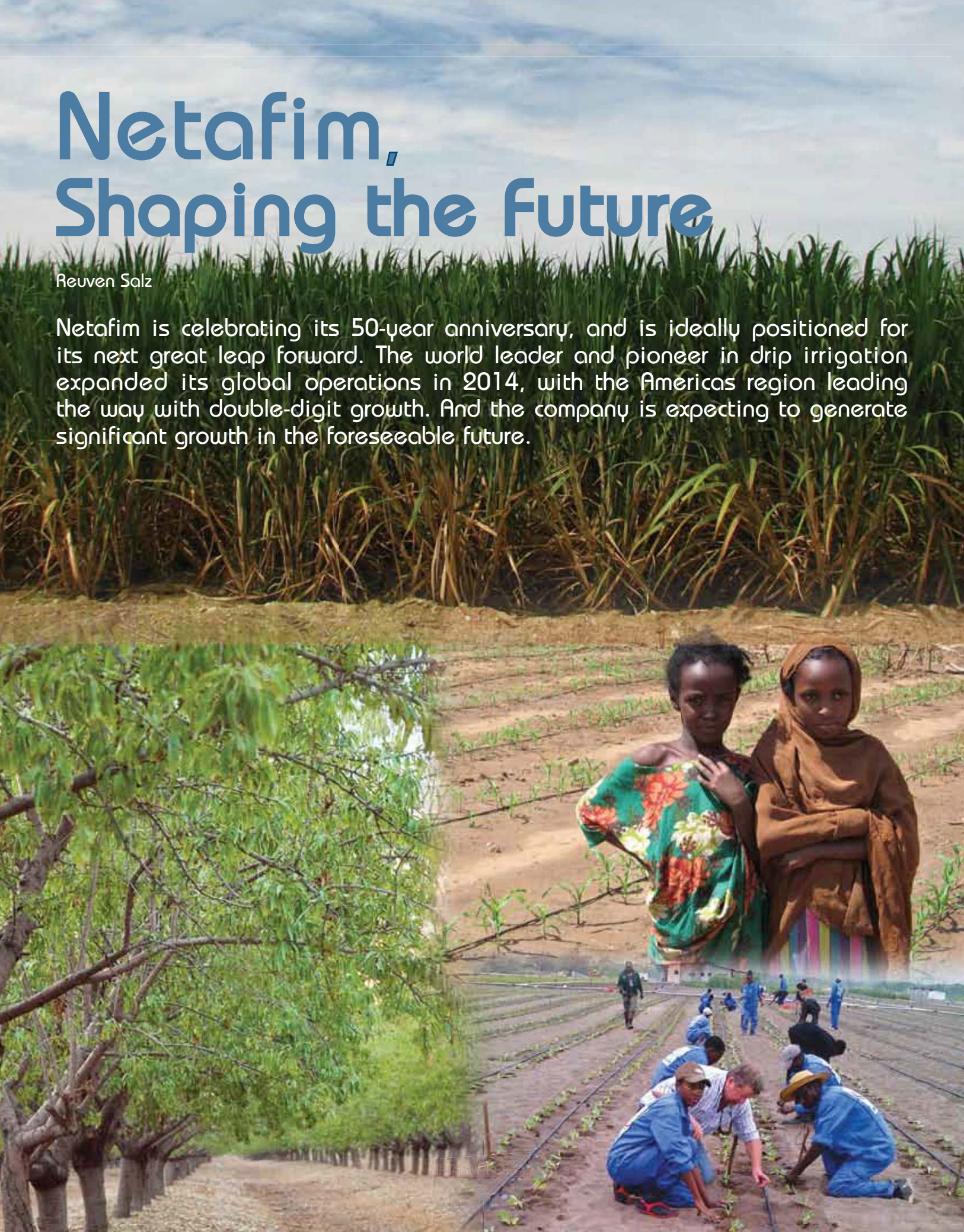
Netafim, Shaping the Future

Reuven Salz

Netafim is celebrating its 50-year anniversary, and is ideally positioned for its next great leap forward. The world leader and pioneer in drip irrigation expanded its global operations in 2014, with the Americas region leading the way with double-digit growth. And the company is expecting to generate significant growth in the foreseeable future.



Netafim At A Glance

Netafim is the world's first manufacturer of drippers. Israeli water engineer Simcha Blass invented the dripper in 1965. The invention was relatively simple - an accessory within an irrigation pipe placed near the plant's roots where water drips directly on to the plant. Since then, the dripper has been improved and adapted to work with various water types and variable pipe pressures. Precisely irrigating the plant, drip technology saves on water and fertilizer. The invention has become a great success in Israel and worldwide, and has spawned a global revolution in irrigation and fertilization methods for agriculture.

Netafim maintains three factories in Israel - at Kibbutz Hatzerim, Kibbutz Magal and Kibbutz Yiftach - and another 13 worldwide, including in Australia, India, South Africa, Brazil and China. Netafim operates a global marketing and distribution network via 28 subsidiaries worldwide. Some 40 billion Netafim drippers irrigate about 2.4 million hectares (24 million dunams) worldwide.

"Netafim delivers innovative solutions aimed at enhancing farmers' profitability through greater crop yields, maximum water savings, significant energy reduction, and efficient nutrient delivery. In addition, the technology reduces soil erosion and depletion," Dr. Yoav Zeif, President of the Americas and Head of Product Offering and Marketing, says.

Success Story

Over 50 years have passed since Simcha Blass, an Israeli water engineer, invented the dripper. Soon thereafter, Netafim established the first dripper factory at Kibbutz Hatzerim in 1965. Born out of a need to combat the severe water shortage in Israel's Negev desert, Netafim, which was founded by farmers, pioneered the drip irrigation revolution, creating a paradigm shift toward low-flow agricultural irrigation.

Since its establishment, Netafim has been the global leader in drip. With 28 subsidiaries, 16 production plants and over 4,000 employees worldwide, the company operates in over 110 countries across the globe. Leading the way in drip irrigation, Netafim helps farmers grow more with less. Netafim integrates technical and agronomic expertise and 50 years of experience into its cutting-edge core products to offer the market's most advanced solutions. The company maintains annual sales of about $800 million and an over 30% share of the global drip market, while continuing to grow in major territories.

The Cutting Edge

Dr. Yoav Zeif, President of the Americas and Head of Product Offering and Marketing, is buoyant about

Milestones

- **1965** - Founded at Kibbutz Hatzerim in Israel's Negev desert
- **1966** - Introduces world's first commercial dripper
- **1978** - Introduces world's first pressure-compensated (PC) dripper
- **1981** - Establishes first international subsidiary, Netafim USA
- **2007** - Introduces world's first low-flow dripper
- **2011** - Permira private equity firm acquires controlling interest
- **2013** - Named Stockholm Industry Water Award (SIWA) Laureate
- **2015** - Celebrates 50th anniversary

Netafim's future. "We provide our customers around the world with services such as agronomic mentoring, while our engineering department offers end-to-end support and customized solutions. Over the years, we have positioned ourselves as best as possible when it comes to micro irrigation in agriculture. In particular, we are the first company to penetrate new crops and new segments. Now we're focusing on bringing drip irrigation to commodity crops such as sugarcane, corn and rice. The company is continuously developing and upgrading, and after 50 years, there's no doubt that Netafim is at the cutting edge of the sector."

Zeif expects that given the significant increase in global demand for food, combined with the growing water shortage and climate and energy challenges worldwide, the need for Netafim's products will only increase. "We're experiencing tremendous momentum in growth. That's why we are investing in growth engines, and have entered new countries and regions such as China and Africa and new territories in India. We've also been developing new products and systems, and now offer a winning irrigation solution."

How is the company dealing with the increasing water shortage?

"The global water shortage is significant for us. It's also what spurs us on. There's no doubt that Netafim offers the best solution in light of today's realities. Drip leads to water savings of up to 50% compared to flood irrigation. Drip also gives customers peace of mind, and increases profitability by saving on water, fertilizer and energy. And no less important these days, drip is good for the environment, providing just the right amount of irrigation needed without wasting energy or water. In addition, it doesn't pollute the ground with chemicals as is the case with other irrigation systems."

Smart Irrigation

Netafim has changed the face of irrigation, leading the field and accelerating development. The company delivers a comprehensive irrigation solution - from dripperlines and irrigation accessories such as filters and valves, through crop management systems featuring automated operation and maintenance systems equipped with sensors and monitors, to fertilizer application systems. "The company is growing and developing new markets worldwide, while continuing to invest in the Israeli market, our testing ground for new system development," Zeif says. "Israel is where we develop all of our automated and fertilization systems."

Does the company place a special emphasis on service?

"The delivery of service to the individual farmer and to large corporations is one of our most important missions as a global leader. Our technical and agronomic support is available throughout the world. Such support helps farmers grow more with less, while giving them a feeling of security and peace of mind. We reach all of our customers no matter where they are, and deliver a complete solution comprised of systems from the entry level and up, along with design and consultation services, as well as ongoing agronomic support. Our accessibility to the marketplace is a huge advantage. For example, we stand by each and every customer whether in Israel, Peru or India."

Agriculture in the Face of Technology

Netafim continues to develop innovative products, and is at the forefront of irrigation technology, with a forward-looking view of the rapidly-changing world markets. "Being a pioneer has its advantages, and we are number one," Zeif says. "Our products are undoubtedly the market's best, and at the end of the day, they're high-tech in nature. We also have experience in non-traditional areas, since drip works with desalinated and gray water. We invest in

recycling and in intensive agriculture in order to progress. Another area in which we are innovative is our tailored greenhouse solutions and capabilities. We have an entire unit dedicated to developing advanced automated irrigation solutions for greenhouses. In our most advanced greenhouses, customers generate tomato yields of up to 80kg per square meter," Zeif says.

And the future looks brighter than ever, according to Zeif. "Drip is a market in the midst of tremendous growth of about 10 percent per year. I believe this growth will further accelerate, especially in the Far East. Agriculture is gradually becoming a tech-driven industry. There are fewer farmers, but technology is making more inroads leading to greater efficiency. There's far more technology in agriculture than in the past, and the ability to advance and increase accuracy reduces environmental impact and improves the environment. The possibilities for further progress are virtually unlimited. For example, by lowering the amount of fertilizer by about 30 percent, we also reduce the amount of energy needed while increasing output."

How is globalization making an impact?

"There's no doubt that globalization has an impact on agriculture, and this applies to the entire supply and marketing chain. Huge corporations have emerged in the seed market, in mechanization, and in many other areas. The need for research and development is greater than ever, and the advantages of scale are increasing considerably. There's a trend toward merging farms, and scaling up definitely offers significant advantages. But there are still about 500 million small-scale farmers worldwide to whom we must also reach and sell. Clearly, the world is moving toward globalization. Given our business interests all over the world, we're preparing for changes in the global economy, but at the same time we're not forgetting the small-scale farmer."

What are your research and development plans in the coming years?

"The future is in agriculture, specifically in precision agriculture. There are insufficient natural resources around the world, and the need to minimize environmental damage compels us to be extremely precise. With lower water pressure and water quality across the globe, we're moving toward a world in which products must be reliable. We must adapt our R&D to these agricultural and technological developments and to changes across the planet.

"As a global leader, Netafim has an important role to play as we move ahead. Netafim is the market leader, and it embraces the privilege and responsibility of promoting smart irrigation worldwide. Since our establishment, we've developed innovative solutions to shape and advance agriculture. Today, 50 years later, we're committed to continue leading the way in drip irrigation, investing in new territories, new products and new crops in order to make a positive change and shape the future of agriculture." ■

Dr. Yoav Zeif - President of the Americas and Head of Product Offering and Marketing

As President of the Americas, Zeif is responsible for overall management of the division, including business development, sales, marketing, finance, production, operations, HR and administration. In addition, he is involved with formulating the region's long-term strategic vision. Zeif is also responsible for Netafim's global product offering and marketing, including its crop management technology (CMT) unit, which is leading the way in automated agriculture.

Prior to joining Netafim in 2012, Zeif served in a number of positions at Makhteshim Agan Industries (MAI), including Senior Vice President, head of Product and Marketing, and head of Product Development and Registration. Before joining MAI, Zeif was an Associate Principal at McKinsey & Company, where he specialized in agrochemicals, telecom and banking. During that period, he was also a fellow of the McKinsey Global Institute in San Francisco. At the outset of his professional career, Zeif was founder and CEO of an e-Learning startup.

International Water Report

Netafim Signs $500 Million Financing Facility Agreement

Ran Maidan, CEO, said: "Facility will enable Netafim to realize its growth strategy, including increased activity in developing countries and in large irrigation projects globally"

Netafim, the global leader in irrigation, announced that it has signed a 5-year, $500-million financing facility agreement. The facility is comprised of $150 million long-term loan and $350 million of revolving short term loans and lines of credit for working capital and project-related guarantees. The lending syndicate is led by Bank Hapoalim, and includes: HSBC, Mizrahi-Tefahot Bank, Migdal Insurance and Financial Holdings, Union Bank of Israel, and Israel Discount Bank.

"The financing facility will be used for strategic growth purposes in developing markets such as India, China, Brazil and Africa, and will enable us to significantly increase our involvement in large irrigation projects," said Ran Maidan, Netafim CEO. "The growing and continuous demand for irrigation solutions, particularly drip irrigation solutions, offers significant growth potential for Netafim. The financing facility will support us to reach our strategic goals, develop new products, promote technological innovation, and above all, strengthen our global leadership position."

"The new Facility will replace the existing arrangement. By leveraging the current financial market situation, we improved our financing terms and increased our operational flexibility, said Lauri Hanover, Netafim CFO.

"The agricultural market in general, and drip irrigation in particular, sits at the heart of a number of important global issues," Maidan added. "These include increasing demand for food, due to rapid world population growth, while the planet's water and arable land resources are finite. At the same time, the agricultural sector is the world's main consumer of water. As a result, there is a growing demand for better and advanced irrigation solutions and greater agricultural efficiency. These trends, along with Netafim's unique global presence and innovative, high-quality products, present us with a significant growth opportunity. This financing agreement will enable us to realize such growth potential."

Established in 1965, Netafim is celebrating its 50-year anniversary under the theme "50 Years of Shaping the Future." The Company recently announced it was chosen to participate in the world's largest micro-irrigation project in the South West Indian state of Karnataka. The $60 million Ramthal (Marol) project covers nearly 30,000 acres of farmland, helping some 6,700 smallholders from 22 villages improve their productivity and livelihood, while saving 50% in water consumption.

WIFA awards their 2014 Clean Water Project of the year to the City of Prescott

The Water Infrastructure Finance Authority of Arizona (WIFA) selected the City of Prescott to receive WIFA's 2014 Clean Water Project of the Year award. WIFA will present the award during the City of Prescott Council Meeting on Tuesday afternoon.

The 2014 Clean Water Project of the Year was for the Airport Water Reclamation Facility Expansion, a $42 million infrastructure project to expand treatment capacity to accommodate current and near-term needs of the community. Prior to the upgrade, the facility's technology and design limited the Prescott's ability to support a higher level of treatment and capacity. The expansion and renovation project began in November 2012 and was recently brought online. The City of Prescott now has the ability to treat increased future wastewater flows and produce more Class A+ reclaimed water.

The WIFA Board of Directors selected the project for award based on Prescott's focus on fiscal sustainability, exceptional project management, and commitment to improving Arizona's quality of life through wastewater infrastructure upgrades.

Planning for such an extensive

and important project involved anticipating system users' future needs and demands, as well as setting user rates appropriately. This foresight and planning allowed Prescott to complete this essential infrastructure improvement project effectively and efficiently.

WIFA is a state agency dedicated to protecting public health and promoting environmental quality through financial assistance for water and wastewater infrastructure. WIFA offers funding for drinking water, wastewater and stormwater projects designed to ensure safe, reliable drinking water and proper wastewater treatment. Over the last 25 years, WIFA has invested over $2 billion in Arizona's communities.

Saudi Arabian researchers announce the development of water saving trees

A Riyadh, Saudi Arabian based company has announced that they have planted 2,300 trees of six varieties for in Qurais, Eastern Province, for the Saudi Aramco company.
The trees, among them Maringa, Zizves, Neem, Arabic Cedar, Acacia Arabia and Pazaromia varieties are intended to help prevent climate change in the region and create a green environment for Saudi Aramco employees, thanks to the use of.

a super water-saving polymer developed by the Estefaa Group and a local inventor.
According to a spokesperson for the Estefaa Group the trees will be planted on 5.5 km of land at set intervals. After planting the company plan to each tree with 200 liters of water, with the use of the super-absorbent polymer.
After they will be watered every two weeks for about two years, after which they will only be dependent on the region's sparse quantities of annual rainfall for water.
The company is upbeat about the project as Saudi Aramco has promised other tree-planting assignments if the venture proves successful.
The new development is based around a water-absorbing polymer,

Polykem Hydrogel PAgriSap, similar to salt that absorb large quantities of water. If it is placed in soil, it absorbs 600 times its own weight in water.

Valmont Announces Fourth Quarter and Fiscal Year 2014 Results

Valmont Industries, among the leading global providers of mechanized irrigation equipment for agriculture, reported fourth quarter sales of $152.2 million for the quarter a decline of 21% from the same period in 2013, which the company attributed to lower activity in North American markets.
International results in Valmont's Irrigation Segment, which accounted for a total of 19% of company's fourth quarter Sales showed an improvement despite unfavorable currency translation effects.

Strategic water management study for New Zealand scheduled

A strategic water management study of the Northland region of New Zealand is to be commissioned with the intention of identifying specific region where water supply and potential water infrastructure could deliver economic growth and other benefits.
The study is an important step in a joint project involving the Northland Regional Council, economic development agency Northland Inc and the Ministry for Primary Industries' (MPI) Irrigation Acceleration Fund. A tender process has recently begun to seek a specialist provider to carry out the water management study.
The study will look at the potential demand for irrigation water, identify ways to improve management and use of current available water resources, identify the economic costs and benefits of water storage and irrigation development, and highlight potential infrastructure development opportunities for future consideration.
The project had its beginnings when Northland Inc promoted the concept of a study focusing on the potential economic benefits of better water management in Northland to MPI and the regional council.
The study is targeted to be complete by September, to allow decisions on future steps to be made before the end of the year.

New technology reported to improve treatment of oil and gas wastewater

Oil and gas operations in the United States generate more than 20 billion barrels of wastewater per year., with the saltiness of the water and the organic contaminants it contains traditionally making its treatment both difficult and expensive, that a large percentage of this valuable commodity being written off.
Engineers at the University of Colorado, Boulder look like they might be able to reverse this trend, thanks to a simple process which relies on a microbe-powered battery, that they have developed. The research team in Boulder claim that their new development can simultaneously remove salts and organic contaminants from the wastewater, all while producing additional energy. The new technique, was recently revealed.
According to a spokesperson from the University of Colorado explained that the beauty of the technology is that it tackles two different problems in one single system.
"The problems become mutually beneficial in our system--they complement each other--and the process produces energy rather than just consumes it." Summed up the UC spokesperson.
The new treatment technology, called microbial capacitive desalination, is like a battery in its basic form, although instead of the traditional battery, which uses chemicals to generate the electrical current, the microbial electrochemical approach takes use microbes to generate an electrical current that can then be used for desalination."
This microbial electrochemical approach takes advantage of the fact that the contaminants found in the wastewater contain energy-rich hydrocarbons, with the microbes used in the treatment process essentially devouring the hydrocarbons and, in the process, releasing their embedded energy, which is then used to create a positively charged electrode on one side of the cell and a negatively charged electrode on the other, essentially setting up a battery.
Not only does the system allow the salt to be removed from the wastewater, but it also creates additional energy that could be used on site to run equipment, the researchers said.
Some oil and gas wastewater is currently being treated and reused in the field, but that treatment process typically requires multiple steps--sometimes up to a dozen--and an input of energy that may come from diesel generators.
Wastewater is often disposed of by injecting it deep underground, Because of the difficulty and expense, with the need to dispose of wastewater has increased in recent years as the practice of hydraulic

fracturing, or “fracking,” has boomed. Fracking refers to the process of injecting a slurry of water, sand and chemicals into wells to increase the amount of oil and natural gas produced by the well.

Irrigation to Improve Productivity for Kenyan Farmers

Kiambu County, situated in the former Central Province of Kenya, adjacent to the northern border of Nairobi County has set aside 95 million Kenyan Shillings ($104 million) for irrigation projects across the county in a bid to exploit and maximize productivity in the semi-arid areas.

County Governor William Kabogo stated that amidst the cash crunch in counties, Kiambu was committed to fostering development and would ensure that agriculture, which is the main economic activity, thrives.

The irrigation projects, are in the final stages of completion, are spread across the 12 sub-counties targeting over 20,000 hectares of land,

Speaking in Kiambu at an agricultural consultative meeting, Kabogo said that there was enough water for the projects from water harvesting, water pans, river diversions and boreholes, whilst going on to encourage other governors to provide similar support to Kenyans to deviate from over reliance on rain fed farming.

Kiambu county is training farmers on other methods of farming such as greenhouses and said that farmers were eager to try drought resistant crops as well, with 2,000 farmers set to benefit from the projects.

Germany to fund Kenya’s water supply

At a recent meeting, held in Nairobi, it was announced that Kenya and Germany have signed a series of financing agreements consisting of loans and grants for a total of 38.3 million euros (about 43 million U.S. dollars) to boost Kenya’s water supply

network as well as their sanitation and health sectors.
The German Cabinet Secretary in charge of the National Treasury Henry Rotich announced at the meeting that a loan agreement amounting to 5.5 million euros in loans will be for the financing of the Phase Four Smallholder Irrigation Program in Mount Kenya Region.
The agreement also included a 8.5 million euro loan for the financing of the Development of the Water and Sanitation Sector- Water Trust Services Trust Fund Phase Three.
Germany also extended a 300,000 euro grant to finance a feasibility study for a coherent development program for food security and drought resilience for Kenya's semi arid counties of Turkana and Marsabit.
According to the National Treasury, the loans will have a grace period of 10 years, with a repayment period of 40 years and an annual interest rate of 0.75 percent.
Germany's assistance to Kenya has nearly doubled when compared to 10 years ago.

Drought in Chile hits agriculture, curbs copper production

A drought in Chile is not only affecting the thriving agriculture industry there, but also hampering copper production, a water-intensive business, in the world's biggest producer of the metal, one more factor that could trim an expected surplus this year.
Both of the country's major mining concerns have stated that the extremely dry conditions have hit production due to restrictions on water.
In some parts of Chile, January was one of the driest since records began, exacerbating a drought that began in 2007, while Winters in central Chile are becoming drier because of climate change.
Anglo's Los Bronces mine in central Chile, the world's sixth-largest copper producer, has been especially hard hit, with projections that the water shortage could cut as much 4 percent off Anglo's overall copper output this year.
Lower rainfall and river flow has led the levels of aquifers and reservoirs to drop or dry up completely, giving miners fewer options. In Chile, the situation is complicated by the fact that many of its copper mines are located in the Atacama, the world's driest desert.
Several other Chilean mining companies have already cut their forecasts for 2015 copper production due to geological and technical issues in other countries.
The shortages have also pitted mining companies against farmers and others who fear for the quality and quantity of their supplies.
Increasingly, miners in Chile are turning to more expensive options like seawater desalination and sewage treatment plants to get water for their needs and for the communities around them, driving up costs.

Singapore expands presence in India with training help

Singapore has launched a program to train one hundred Indian government officials, based in the desert state of Rajasthan in water management and conservation and initiated plans to set up an "iconic" skills center there, making for an expanding presence in India.
Singaporean Foreign Minister K. Shanmugam, on a recent visit to India, y held talks with Rajasthan Chief Minister Vasundhara Raje to finalize the collaboration plans between the two sides, which will also see Singapore offering technical expertise on water recycling.
A grant agreement was signed between the Rajasthan government and the Singapore Cooperation Enterprise to train officials in an 18-month program.
The program is supported by Temasek Foundation, which is giving a grant of $420,508, with co-funding of $271,028 coming from the Indian state government.
Rajasthan, which has a population of 73 million people, is a desert state that is often hit by drought and suffers from an acute shortage of water. The state makes up 10 per cent of India's land area, but has access to only 1.16 per cent of its water resources.
A team of Singaporean experts will also share with the Rajasthan government the Republic's experience in water recycling that could be implemented in the state's capital and tourist hub of Jaipur.
President Tony Tan Keng Yam of Singapore was in India earlier this month to kick off celebrations to mark 50 years of diplomatic ties between India and Singapore.

Atmospheric concentrations of carbon dioxide now said to be making the planet a greener place

With warnings of the drastic effects of global warming now reaching fever pitch, some global researchers are now offering a new and more optimistic viewpoint- that, in actual fact, increases in atmospheric concentrations of carbon dioxide are greening the planet, according to research done on the subject.

They claim that as carbon dioxide is plant food it can act as a substitute for water and allows plant life to thrive in areas that would have previously been impossible, including in the world's most arid regions - a phenomenon which they are now calling called "CO2 fertilization." Another factor that the researchers have raised is that as the world gets warmer so the growing seasons in temperate zones get longer, which can add a further spurt plant growth.

Acccording to one of the more prominent and outspoken proponents of the reverse effects of increase carbon dioxide in the atmosphere, extensive, large, and continuing increase in biomass is taking place globally - reducing deserts, turning grasslands to savannas, savannas to forests, and expanding existing forests, which is almost a complete opposite of what the Intergovernmental Panel on Climate Change (IPCC) have repeatedly predicted expected."

In Australia, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) have reported that "CO2 fertilisation correlated with an 11 per cent increase in foliage cover from 1982-2010 across parts of the arid areas studied in Australia, North America, the Middle East and Africa."

According to a spokesperson from CSIRO, "elevated CO2 boosting the foliage in dry country is good news and could assist forestry and agriculture in such areas; however there will be secondary effects that are likely to influence water availability, the carbon cycle, fire regimes and biodiversity."

Jordan and Israel sign a cooperation agreement to help save the Dead Sea

Jordan and Israel recently announced a new groundbreaking agreement that will see the two neighboring countries construct a pipeline that will eventually link the Red Sea with the shrinking Dead Sea and combat regional water shortages.

The agreement was signed in the Jordanian capital, Amman, and will signal the implementation of the first phase of a long-awaited project.

The Red Sea–Dead Sea Conduit

also known as the Two Seas Canal will carry some 100 million metric cubes of water to the north annually, thus hopefully slowing down the process Dead Sea's desiccation. As part of the cooperation, a joint water purification plant will be constructed, with the Israelis, Jordanians and Palestinians all sharing the water.

The agreement signing follows a letter of intent signed in Washington in December 2013 by representatives from Israel, Jordan and the Palestinian Authority that capped more than a decade of negotiations.

The agreement, signed in the presence of representatives from the United States and the World Bank, stipulates the construction of a canal to channel water from the Red Sea to the Dead Sea.
Jordanian Water Minister Hazem Nasser said that 300 million cubic meters of water would be pumped annually from the Red Sea during the first phase of the project. In all four pipelines would be built, with the ambition of eventually pumping two billion cubic meters of water when the project is completed.
The Dead Sea, the lowest and saltiest body of water in the world, is on course to dry out by 2050. The degradation of the Dead Sea started in the 1960s when Israel, Jordan and Syria began to divert water from the Jordan River, the Dead Sea's main supplier.
As part of the project, some of the water pumped from the Red Sea would enter the Dead Sea while the rest would be desalinated and shared with Israel and the Palestinian Authority. The Palestinians are expected to obtain 30 million cubic meters of potable water annually thanks to the project.

Nasser said Jordan will start drawing up documents in the next few weeks calling for international tenders. He said the deal, signed for Israel by Energy and Water Resources Minister Silvan Shalom, safeguards Jordan's national interests.
Shalom, who is also minister of regional cooperation, hailed the agreement as a landmark deal between Israel and Jordan, which signed a peace treaty in 1994. He said the deal will help rehabilitate the Dead Sea and provide solutions to Jordan's chronic water problems, a statement said.
Two years ago, Jordan's water ministry said that the tiny kingdom, where 92 percent of the land is desert, would need 1.6 billion cubic metres of water a year to meet its requirements by 2015.
Water is an essential and rare resource for Jordan which has a population of around seven million and growing, as the country takes in refugees from the Syria war.
However, several environmental groups have warned that the project could undermine the fragile ecosystem of the Dead Sea, which they fear could be contaminated by water from the Red Sea.

Agriculture and Irrigation Ministry promotes land conversion in Northern Peru

The Peruvian Agriculture and Irrigation Ministry promotes the productive conversion of lands, aimed at reducing large areas allocated to the farming of rice, which is causing the waste lands, due to its salinization as a consequence of the high consumption of water.

According to the Peruvian deputy minister of Development and Agrarian Infrastructure and Irrigation the Ministry is "already" working in the conversion of lands of rice in the Tumbes, Piura, Lambayeque and La Libertad regions: through the Program of Productive Conversion. The Farming and Irrigation Plan, which is currently being put in place was intended to define the maximum area to be implemented, in order to obtain a better price also by knowing the water availability as well as "zoning" crops.

In the deputy minister's statement he explained that the nation's farmers can not continue to cultivate rice in the chest due to a shortage of appropriate lands, since these types of soils are loose and water is wasted because of the filtration.
"We intend to convert rice lands into land which will produce more profitable products such as citrus, grapes, asparagus, quinoa, avocado among others" the Deputy Minister summed up, while placing special emphasis on the Peruvian Agricultural Ministy's objective is to "optimize the resource," in order to achieve high profitability and to benefit the farmers' economy.

European Commission to take Greece to task on their wastewater treatment failures

The European Commission is taking Greece to court over their repeated failure to adequately ensure that their wastewater is properly treated.

In the EU, member-states need adequate collection and treatment systems for urban waste water, as untreated water poses risks to human health, inland waters and the marine

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environment. Greece was first warned about this particular case in 2010, concerning areas with a population in the 2000 and 15000 range. Although many of the original concerns have since been addressed, the scale of the remaining problems has now led the Commission to refer the case to the EU Court of Justice.

EU legislation on urban waste water treatment dates back to 1991, with long lead times for the implementation deadlines.

Member-states were given time until the end of 2000 to ensure appropriate treatment of waste water from large agglomerations, and until the end of 2005 for discharges from medium-sized agglomerations, discharges to freshwater and estuaries from small agglomerations.

Greece has lagged behind in implementing the legislation, and the latest reports from the Greek authorities show that appropriate treatment facilities are still lacking in five regions, while in three other areas the Commission took the view that the data submitted is either incomplete, or showed a failure to comply with the appropriate standards.

Agricultural insecticides said to be dangerous for water bodies

According to the first global map to be modelled on insecticide runoff to surface waters, produced by researchers from some of Europe's leading universities have recently claimed that streams within approximately 40 percent of the global land surface are at risk from the application of insecticides,

According to the research findings, streams in the Mediterranean, Southeast Asia, the USA and Central America are particularly at risk with agricultural pesticides are applied to help farmers control insects, weeds and other potentially harmful pests threatening agricultural production.

According to estimates, around four million tons of agricultural pesticides are applied annually, equating to an average of 0.27 kilograms per hectare of the global land surface.

The report warned of an increase in the application of pesticides in many developing countries as farmers increasingly switch from traditionally extensive agricultural practices to more intensive ones.

Until now the global extent of the potential water pollution from the application of insecticides has largely remained unknown.

The researchers intend to use the global map to sensitise citizens and authorities about this issue in vulnerable regions and to incite local investigations.

For example: buffer zones along the edge of water bodies can significantly reduce negative impacts. Efficient environmental management and conservation efforts in the future should focus on informing authorities and farmers about the costs, impacts and alternatives.

Californian Water shortages a near certainty for this summer as feds announce low deliveries.

A clear indication that California expects to suffer a fourth consecutive year of drought, is the news that the State's federal government recently announced that the Central Valley Project, the state's largest water delivery system, will be unable to provide any supply of irrigation water to most of the region's farmers and only 25 percent of the contracted amount to urban areas such as Santa Clara, Alameda and Contra Costa counties.

The announcement from the Bureau of Reclamation means that farmers in California's main agricultural region will fallow hundreds of thousands of acres, and heavily pump already depleted wells, perhaps faster than last year.

It also increases the likelihood of stricter conservation rules -- including fines for excessive water use -- this summer for millions of residents who receive water from the Santa Clara Valley Water District, the East Bay Municipal Utility District and the Contra Costa Water District, all of whom draw a portion of their supply from the Central Valley Project.

The Central Valley Project went into operation during the Nineteen Thirties, channelling water from Shasta Lake near Redding all the way to Bakersfield through a series of 20 dams, 500 miles of canals and huge pumps.

In most years, the project provides nearly 90 percent of its water to farms. In dry years, cities receive priority over most farmers. Farmers, however, with the oldest claims to water could receive up to 75 percent of their contracted amount this year.

The last three years have been the driest three-year period in California history back to the Gold Rush in 1850.

Although Northern California received several strong storms in December and February, those storms have not built up the state's critical Sierra Nevada snow pack, which stood at 19 percent of normal on Friday, due to record hot temperatures in January and February that have melted much of the snow.

Last year, 428,000 acres, or 5 percent of the state's cropland, was left unplanted because of the drought.

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Metzerplas

The forefront of the irrigation revolution-while retaining their traditions and standards

Metzerplas, privately owned by Kibbutz Metzer, situated in the very heart of Israel, is rightfully proud of the place it has taken in spreading the growth of drip irrigation throughout the world, whilst retaining the standards of Kibbutz ideology and remaining in private ownership since their founding.

Kibbutz Metzer still maintains 75% of the shares in the company with the Israeli based Gaon Agro Industries Ltd holding the remaining 25% of the equity in the company.

As recently appointed CEO, Shmuel Shupak, pointed out that the Metzerplas top management team are all members of the Kibbutz and before moving into the drip irrigation plant, which is a very central part of the Kibbutz, were all involved in some form or another in agriculture, and in very much a hands on position.

According to the experience gained in actually cultivating agricultural produce in the Kibbutz's various branches provided them with hands-on insight into what the modern grower requires in order to extract the maximum yield and quality of their crops

Metzerplas, established in 1970, has been involved in driving the irrigation industry forward during the past 45 years, during this time it has accumulated far-reaching and large-scale expertise in all aspects of providing irrigation solutions to growers across the world. With an active in-house research and development department, Metzerplas has also been involved hands-on in the development, design, production of all of its marketing and installation of agricultural and landscaping products as well as handling large-scale turnkey irrigation projects.
The machinery for the irrigation production lines are all manufactured by the Metzerplas engineering department, which also sell production lines to companies world over.

The fact that Metzerplas has completed the qualification process for the international ISO 9001:2000 quality control standard for each and every one of its products

Metzerplas Irrigation designs

Metzerplas Irrigation designs, produces and markets drippers and driplines, PE irrigation pipes as well as fittings and accessories to suit all types and sizes of irrigation systems. Their range of products includes cylindrical and flat drippers designed for subsurface irrigation, integral drippers as well as low pressure and gravity dripping systems.
As well as their extensive range of drip irrigation products, Metzerplas is also regarded as being one of the leading global companies in the manufacture of Alumpex (the S.P. brand) (PE) piping, not only for agriculture but also used for infrastructures specially designed and developed to transport water at extreme temperatures and pressures.

and services, ensures that every new irrigation product has been put through the most stringent laboratory and field tests prior to release for marketing both in Israel and throughout the World.
In addition to producing one of the widest range of "off-the shelf" irrigation products Metzerplas also operates a thriving projects department where its long ranging expertise in agricultural and irrigation turn-key projects for greenhouses and open fields is in demand throughout the World.

Having played a central part in the spread of the awareness of irrigation in the developing world over the last 45 years, Metzerplas is moving steadily into the next half-century ideally placed to remain a key figure in this increasingly important sector in the agricultural world.

Today Metzerplas is developing a revolutionary and innovating new line of water pipes and drippers which soon will be commercial. ■

METZERPLAS

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Shmuel Shchupak

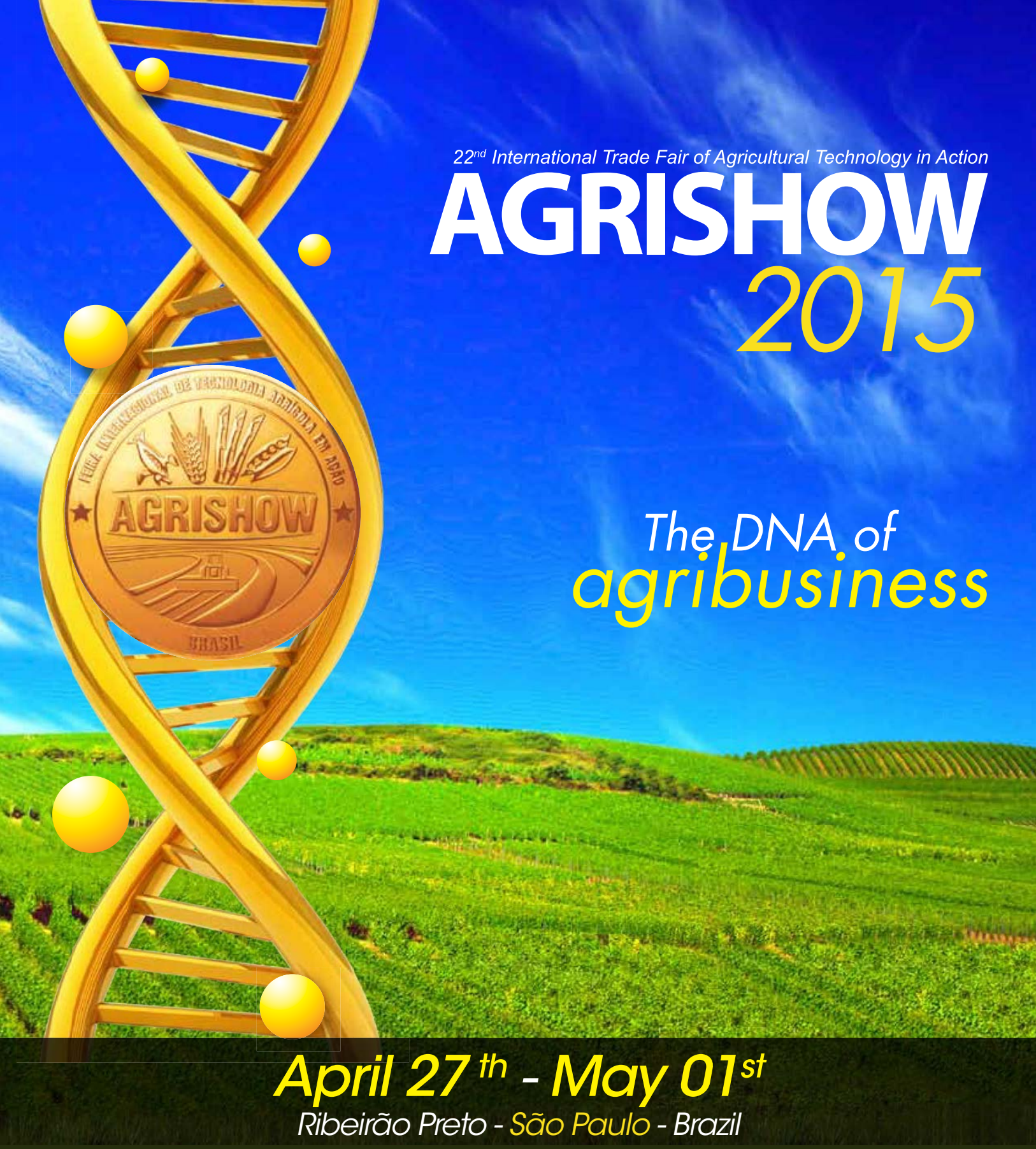
Shmuel Schupak, CEO of Metzerplas was born and raised on the Kibbutz Metzer, son of one its founding fathers. He has a BSc. Agriculture and a MBA from the Hebrew University, Israel. He began his working career in the Kibbutz's extensive Avocado orchards. After joining the Metzerplas export department, he was sent to Australia to establish the Metzerplas Australia company. He moved there with his family for a few years until the company stood on its own feet. On his return to Israel he established the Metzerplas projects department. He left Metzerplas for a few years to become the Managing director of Kibbutz Megiddo, Israel
In January 2013 he returned to Metzerplas and took over the post of CEO Metzerplas from Reuven Sarig.

Reuven Sarig

CEO Metzerplas 2001-2013
Born in 1945.
Married with 3 grown-up children and 3 grandchildren.
Lived on Kibbutz Metzer since 1966.
Served in the Israeli army
Education: B.A., Tel Aviv University.
Past Positions: CEO - Metzerplas (first time in the 90's);
Managing Director - Palma India - India;
Managing Director – MCP. Ha'Maapil, Israel

Omer Lin

The current export manager of Metzerplas .
Has been working in Metzerplas in the marketing department since 1997.
Has been the European marketing manager for over ten years.
He has a BA in business administration.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Richard D. Chapin
one of the first pioneers of drip irrigation

Mr. Chapin had an innovative mind and a big heart for people, their well-being and a desire to give back to his community. He lived and worked in Watertown New York where he founded his business, Chapin Watermatics. In 1950, Mr. Chapin developed the 'Chapin's Mist Watering Machine 'system that ran on an overhead track distributing water to the flowers.
In 1960 he designed and released his first irrigation system, which he named the 'Watermatic System'. This system was designed to deliver water through a main feeder and then directly to the flower pots through micro-tubes, thus improving the efficiencies of the repetitive task of watering the greenhouse flowers. This system was sold to Ohio State University in 1960 and was well received, providing encouragement and confidence for Mr. Chapin to start producing the systems for commercial sale.
Reducing the labor and delivering the exact amount of required water per plant soon proved valuable to Mr. Chapin as well as other greenhouse farmers.

Chapin Watermatics was incorporated in 1962 and the first factory was established on land adjacent to his house on which his father, Willard Chapin built Richard his first greenhouse in 1930. Focusing on the greenhouse needs, Mr. Chapin developed different types of water delivery systems, including pot weights, loop and spray stakes.
Mr. Chapin began recognizing the need of an efficient water delivery system for row crops as he traveled around the country. In the early 60's, Mr. Chapin developed the 'Dew Hose' product and successfully marketed this to mainly residential, small based gardens. In 1964 the first Dew Hose product was commercially introduced and installed on Long Island with the help of Norm Smith, with the crop being tomatoes.

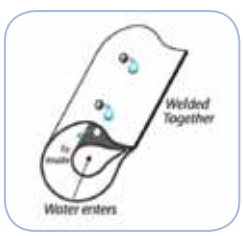
Focusing on the greenhouse needs, Mr. Chapin developed different types of water delivery systems, including pot weights, loop and spray stakes

A flurry of design changes occurred from the early 1960's thru the mid 1990's, including:

1964 - Dew Hose

- Single chamber.
- Drip outlet
- Well suited for residential, smaller gardens.

1970 - Twin Wall



- Two chamber type hose.
- Better flow rate and uniformity.
- Could be used by the commercial farmer.
- Introduced to the California market in 1970 with pole tomatoes being the first target crop.
- Squirt outlet.

1980 - Drip Hose

- Used in rough terrain.
- Thicker mils of 12 and 14.
- Longer row capability.
- Squirt outlet.

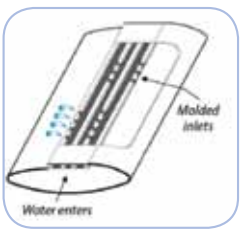
1980's - Tri-Wall

- First used on strawberries under mulch.
- Drip outlet.

W-4 Tape:

- Larger flow channel.
- Increased passages per outlet.
- Used on top off or under mulch.
- Drip side outlet.

1980's - Twin Wall 4

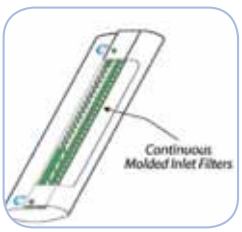


- Improved Multiple Inlets and Outlets to provide additional assurance of flow in a case of a clogged condition.

1984 - Turbulent Twin-Wall

- Continuous filter.
- Improved clogging resistance due to the design of the flow channel.
- Longer row lengths.
- Drip side outlets.

1990- Cane Turbulent



- Higher flows available.
- Shorter flow channel.
- Top outlet, single hole.

These years of innovation paved the way to the current products:

Deluxe

- Slit design outlet helps to prevent root intrusion and soil ingestion.
- Available in 5/8" and 7/8" diameters.

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- Largest available selection of flow rates.

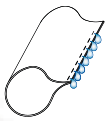
During this time Mr. Chapin and his design team continually sought out answers to the grower's problems and needs, resulting in this history of product developments along with 25 patents.

In 2006 Mr. Chapin, in his eighties, sold the Company to the Jain Irrigation Company. This allowed him to concentrate on his philanthropic activities as Executive Director of Chapin Living Waters Foundation.

Chapin Living Waters Foundation distributes thousands of gravity fed; bucket kits to more than 150 countries worldwide, helping families produce crops that sustain their nutritional needs even during drought conditions. Living well into his 90's, Mr. Chapin continued to oversee the distribution of the Bucket Kit's. As his business card read: "If you missed knowing me, you missed nothing. If you missed knowing my Lord and Savior, Jesus Christ, you have missed everything." In the mid 1940's, Mr. Chapin modeled his business approach in a manner that partnered him and the company with God. His faith and trust in Jesus led him to communicate with Him on a regular basis and asked Him frequently to help guide Mr. Chapin though any particular problem or issue.

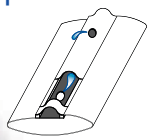
Mr. Chapin passed away in 2014 at the age of 96, having played an important part in the founding concept of drip irrigation as we know it today.

1964
Dew Hose

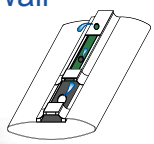


1970
Twin Wall

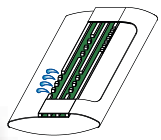
1980
Drip Hose



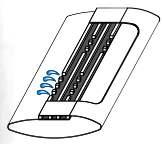
1980's
Tri-Wall



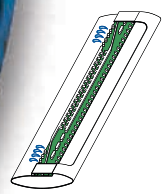
1980's
W-4 Tape



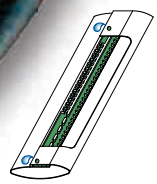
1984
Twin Wall 4



1990
Turbulent Twin Wall



1990's
Cane Turbulent



Chapin Drip Tape, a long history of quality, innovation and extending a helping hand.

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New tools for irrigation

Gaetano Di Maiuta, CEO of Plast Project Srl

The use of water, especially in agriculture, needs to be rationalized and optimized. The latest developments in agricultural irrigation are described by Gaetano Di Maiuta, CEO of Plast Project Srl.

The conscious and sustainable use of water resources is imperative for our society. This is even truer in agriculture, where the chronic water shortage is forcing operators to experiment with new methods for irrigating fields that allow water consumption to be optimized and ensure the most effective use.

"In this sense, given their characteristics, micro-irrigation and drip irrigation systems are without doubt the best solution," says Gaetano Di Maiuta, CEO of Plast Project in Francofonte (Siracusa), Italy. The company specializes in making products and accessories for irrigation and agricultural and residential micro-irrigation, and is currently a company at the forefront in this particular field, boasting more than 2,000 items in its catalogue.

What ideas form the basis of your products?

"Our goal is to improve traditional irrigation techniques by means of innovative products that fit the needs of a constantly changing market. That is why we create high-quality fittings, valves, sprinklers and water drippers with new designs that are tested and comply with industry regulations.
The entire production cycle, from the research and development of products and components to the thermoplastic injection moulding, is performed in our own facilities. This gives us a degree of flexibility that is hard to find elsewhere, and is something that our partners greatly appreciate".

So, research and development would seem to be fundamental. What is Plast Project's approach to this?

"Each year we allocate substantial resources to update our design and engineering software (CAD/CAE), along with the CNC machines used

> Each year we allocate substantial resources to update our design and engineering software

to create the moulds. Plast Project was one of the first companies in the industry to obtain ISO 9001 (2000) and ISO 14001 (2008) certifications. These important awards are the result of our extensive experience in the field of plastic moulding and steel processing for the creation of moulds, as well as our constant attention to protecting and respecting the environment".

How is this concern for the environment put into practice?

"For several years now we have been actively replacing our hydraulic moulding presses with the latest generation of electric presses, which are more efficient and environmentally friendly. In addition to this, most of our energy needs are met by a recently installed photovoltaic system that allows us to minimize harmful emissions".

Plast Project exports its products worldwide. In what markets does your business do best?

"We are a global operator, though the Americas and Eastern Europe are currently our most active markets. We are always looking for new partnerships, and that is why we also regularly take part in large international events and exhibitions".

To what extent has the economic crisis affected your business sector and what strategies have you adopted to deal with this situation?

"The crisis has certainly been felt, this is undeniable. However, we believe in the soundness of our corporate policy, which is based on high-quality products and complete respect for the customer. Thus despite having to cope with continual increases in raw material prices, we have not raised our prices, so as not to place further strain on our clients' finances. It is a big sacrifice, but I have to admit that this decision has paid off".

What are your expectations for the future?

"The results we have achieved over the past few months have given us a bright outlook for the the future. We reported a significant increase in turnover last year, which we expect to see again this year. Our goal is to expand and improve our product range, because this is the only way to gain significant new market shares". ■

Plast Project

Quality in irrigation

www.plastproject.com

Thanks to its wide range of solutions, AZUD consolidates itself as a safe bet in the agricultural sector

AZUD Group stablished several decades ago in one of the most arid regions of Europe, with historical problems of lack of water, favouring the development of an intensive agriculture highly productive, based on efficient irrigation systems. From the beginning of its course, AZUD has used an important part of its economic and human resources to the development of technologies and products that allow the efficient use of ***water, energy and fertilizers***, giving answer to the main requirements of the agricultural sector and favouring the drip irrigation practices.

As a result of this effort, AZUD is the only manufacturer company of the market that supplies a global solution, with products and solutions comprising IRRIGATION, FILTRATION and WATER TREATMENT. Its wide experience in the drip irrigation enables it to supply the most interesting agronomical solution for each crop: from the most adequate products to the technical advice for the design, start up and maintenance of the installation; giving answer to the main necessities of the agricultural sector nowadays.

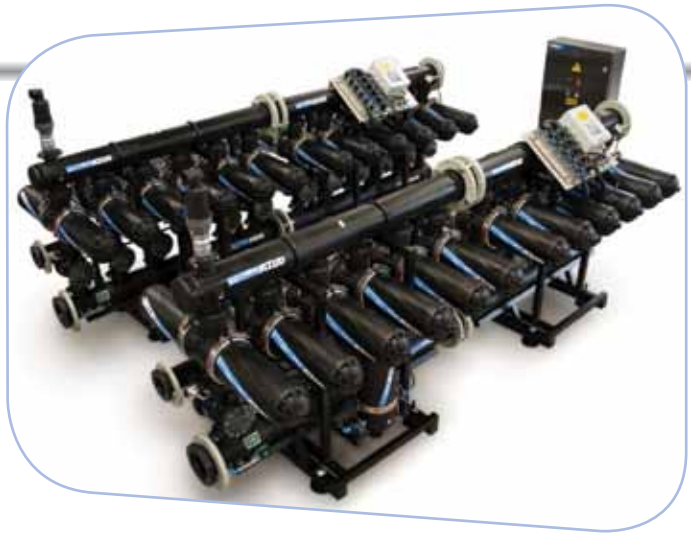
AZUD offers, among others:

- **Drip irrigation systems for surface and/or subsurface.** AZUD guarantees the maximum anti-clogging efficiency with its wide range of driplines, thanks to DS-Technology patented system, the technology that defines the distribution patron of water through the drip emitter and that guarantees the uniform application of water to the crops.

- **Efficient filtration systems working with low pressure.** AZUD HELIX SYSTEM is the clogging delayer system patented by AZUD for the filtration equipment, which turn them in one of the most effective systems of the market. Furthermore, AZUD offers filtration solutions which reduce the pressure and the water during the back-flushing process, optimizing the process and improving the energetic cost of the installation.

- **Fertigation systems adaptable to the requirements of each Project.**
  Thanks to the Venturi Effect, AZUD QGROW systems

Subsurface Drip Irrigation in olive tree



allow the selection of the injection levels demanded by the system, independently from the flow rate and pressure existing, and making easier the dose of the nutrient, the installation and the maintenance.

- **Irrigation solutions for gardening and landscaping.**
  AZUD GREENTEC is the professional microirrigation system for landscaping made by a set of products specially designed to simplify, save and integrate perfectly each installation in the green area.

- **Mining solutions.**
  On one side, AZUD develops lixiviation projects of materials as gold, silver, copper, nickel or zinc in Europe and Latin America. On the other side, the filtration system and water treatment, allow the mining companies an efficient use and handling of the water.

- **Solutions for the treatment and use of waste water.**
  The high structural water shortage in most watersheds with presence of agricultural areas, joined to the increase of the demand and high uncertainty of temporal and room availability, favours the search and use of non-conventional water resources. AZUD designs, produces and offers products that permit the sustainable use of treated waste water in irrigation systems.

Expansion lines of the Company

The Company plans to double its turnover in the next 5 years, with three key concepts:
TECHNOLOGY - SOLUTIONS –
INTERNATIONAL COMPETITIVITY.

The ways to achieve this goal are:
Design and engineering of products and solutions:
Understood as the continuous improvement of quality, efficiency and innovation in our productive processes.

Brand and internalization of its products.
AZUD is a multinational company trying to adapt itself to the specific requirements of each market and each country, striving to be each time closer the farmer. AZUD is present in more than 70 countries of the five continents, through a wide net of subsidiaries and distributors that continue growing up.

Training and support to the most disadvantaged areas.
In the last years, AZUD has been working to extend and popularized the use of efficient irrigation, filtration and water treatment systems in developing countries or non-intensive agriculture, where this have an important socio-economical relevance.
We also keep our social compromise, collaborating with NGOs in education and training projects.

Efficient Team
AZUD is made of a young and highly trained team. AZUD´s team is compromised and works diary with illusion, passion and professionalism. The Policy of Human Resources is based in the continuous training and the welfare of its workers.
Looking ahead AZUD will continue working to optimize the use of hydric resources, faithful to its compromise with The Culture of Water. ■

AZUD

www.azud.com

Guardian Air/Vacuum Valves for Vacuum Protection in Drip Irrigation

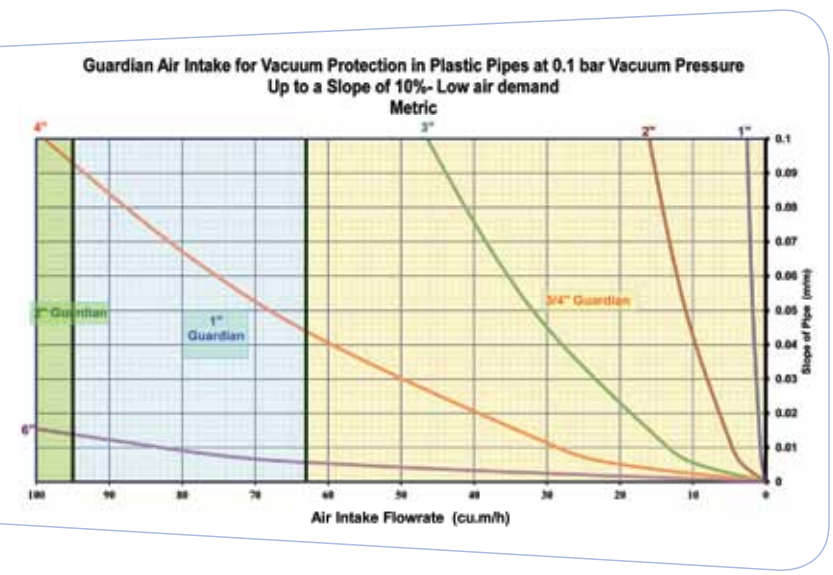
Naftali Zloczower, *B.Sc.C.E., A.M.ASCE, Licensed Civil Engineer (Israel), A.R.I. Flow Control Accessories Ltd.*

In drip irrigation, especially subsurface drip irrigation, vacuum prevention is essential, even at very low negative pressure, for the prevention of suction of dirt through drippers, as well as for the prevention of damage to piping and accessories.
There are three major causes for the formation of vacuum cavities in manifolds from which dripper laterals emanate *(distribution manifolds)* and in manifolds to which they drain *(collection manifolds)*.

1. At sudden pump stoppage or valve shut-off, water column separation occurs after the inline isolating valve and at peaks, because water supply is suddenly stopped, yet, the existing water mass continues to flow, driven to the forces of inertia. Vacuum cavities are, thus, developed, exerting negative pressure and suction.

2. At system drainage, if air is not admitted at the rate water is drained, vacuum cavities form, exerting negative pressure and suction. In extreme cases, this can result in pipe or accessory collapse.

3. At pipe or accessory burst *(blind flanges, risers, or on-line isolating valves breaking off, for instance)*, water is drained, sometimes at great flow rates. If water supply is slower than the rate of drainage, and air is not admitted into the pipe, vacuum cavities form, which cause suction and, sometimes even pipe or accessory collapse.



For the above reasons, large orifice, kinwwetic, air/vacuum valves are required:
a. After inline isolating valves at valve heads, and in distribution and collection manifolds,
b. At peaks along distribution and collection manifolds,
c. On tops of risers at the ends of the manifolds.

Sizing of the air valves should be determined according to the maximum water flow rate at water column separation.

- If the field is relatively flat, without serious elevation differences and/or significant slopes, yet the operating flow rate is significant, air valve sizing should be determined according to the operating flowrate. The reason for this is that at sudden valve closure, the water column continues flowing at the operating flow rate, at least for a very very short time. Thus, air intake should be equal to the operating flow rate.
- If the field has a varied topography, with differences in elevations and/or significant slopes, air valve sizing should be determined in accordance to the maximum drainage flow rate at controlled drainage or burst *(the higher of the two)* .Air intake should be equal to maximum drainage flow rate.

To prevent suction even at very low negative pressures, air intake should be determined at low negative pressure, say 1.45 psi *(0.1 bar)*.

Dripping System with
A.R.I. AV-010 + DT-040 Air Valves

Enclosed, is a sample of a graph to help in determining the number and the size of "Guardian" air valves required for vacuum protection in plastic manifolds at 1.45 psi *(0.1 bar)* vacuum pressure.
The slope to be considered is the steepest slope, of any section of the manifold, from the location of the air valve, to the lowest point, on either side of the air valve, not protected by another air valve.
If the Air Intake Flowrate determined by the slope is lower than the operating flowrate at the particular section of the manifold, use the operating flowrate to determine air valve sizing.

For instance, if the manifold is 4" *(100mm)* in diameter and the slope is 5% *(0.5 ft/ft ,0.05 m/m)*, the air intake flowrate is 300 GPM *(68 m^3/h,)*, according to the graph. If the operating flowrate is, say, 370 GPM *(90 m^3/h)*, sizing should be determined by the operating flowrate. According to the flowrate determined by the slope *(300 GPM, 68 m^3/h)*, one 1 in. "Guardian" would be sufficient. But, as can be seen from the graph, at 370 GPM *(90 m^3/h)* operating flowrate, one 2 in. "Guardian" is required, and this is the air valve that should be mounted.

The graphs' plot areas are color coded according to the number and sizes of "Guardians" required, to make the graphs easier to read.

Dripping System with Ooval's Control Valves and A.R.I. Guardian Air Valves in the Snow

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Dry matter and macro-nutrient accumulation in fruits of Conilon coffee with different ripening cycles

Introduction

Coffee boasts more than 100 described species, although only three of the species are grown commercially to make the hot drink we all know and love.

The most popular varieties of coffee are:

- C. Arabica
- C. Canephora
- C. Liberica

Although the species C. Arabica is the most commonly grown species throughout the world, the cultivation of C. Canephora has played a major part in increasing world coffee production.
In Brazil, one of the World's leading coffee producers, almost 25% of all of coffee cultivated in the massive country is of the C. Canephora variety.

In Brazil, one of the World's leading coffee producers, almost 25% of all of coffee cultivated in the massive country is of the C. Canephora variety

For growers, knowledge of the ripening process of the coffee fruit is regarded as being critical for agricultural planning, taking into account predicting date of the harvest, as well as fruit quality, which will allow for the product to reach the market in the peak of its readiness.

Over the years, a number of important studies on the process of gene expression in different periods of fruit development have been carried out, with the term "maturation cycle" been increasingly brought into use in order to accurately predict the timing of this period, which relates directly to the time between flowering and fruit ripening.
In coffee plants maturation cycles generally vary, and are dependant on a combination of climatic conditions as well as the coffee genotype grown.
C. Canephora reproduce by a process known as allogamy, in which pollen is transferred from one flower to the stigma of another. As the most common form of sexual reproduction in plants Allogamy is vital in obtaining productive varieties with defined maturation cycles.
In addition to cycle differentiation, the length of each stage of the cycle generally varies and its timing may have a negative affect on dry matter and nutrient accumulation rates in fruits.

The period of fruit formation coincides with the period of higher vegetative growth. For example, when there is increased requirement for coffee nutrients, which
in the State of Espírito Santo, one of the principal regions of coffee cultivation in Brazil, usually runs between September to May.
To be ready for any fluctuation in the level of coffee nutrients it is important for the grower to fully understand the dynamics of fruit formation in order to recognize when the periods of increased nutritional demands come around and fully define their most efficient strategies for crop fertilization.

To compensate for the general lack of information on this phenomena, a recent study was carried out in order to establish dry matter and macronutrient accumulation curves in fruits of 'Conilon' coffee plants with distinct maturation cycles, which fall into the categories of early, intermediate, late and very late.

Materials and methods

The trials were carried out in the state of Espírito Santo in Brazil, a region which boasts an average elevation of 100 metres above sea level. Average minimum temperature in the region from from 11.8 to 18°C, with a maximum ranging from 30.7 to 34 °C.
The rainfall rate for the region is approximately 1,200 mm annually. During the course of the trials, the coffee crop

was properly irrigated and went through absolutely no difference in water supply.

During the trial three-year-old C. Canephora Conilon plants were used, grown with a spacing of three meters between rows and one meter between plants, with four orthotropic stems per plant, while.

Training of the the plants were managed according to recommended and generally used technical recommendations for the crop.

Fertilization was performed through the irrigation system, with 110 gram of simple superphosphate and 80 grams of 20-00-20 formulate applied during November and December, respectively, and 100 gram and 120 gram of both materials applied during the month of March and May. The treatments were composed of four genotypes *(clones)* of coffee trees with different maturation cycles *(early, intermediate, late and very late)*.

A completely randomized experimental design was used containing five replicates *(five plants)*. Initially, 70 plagiotropic branches with the same pattern per genotype were picked out and marked at random.

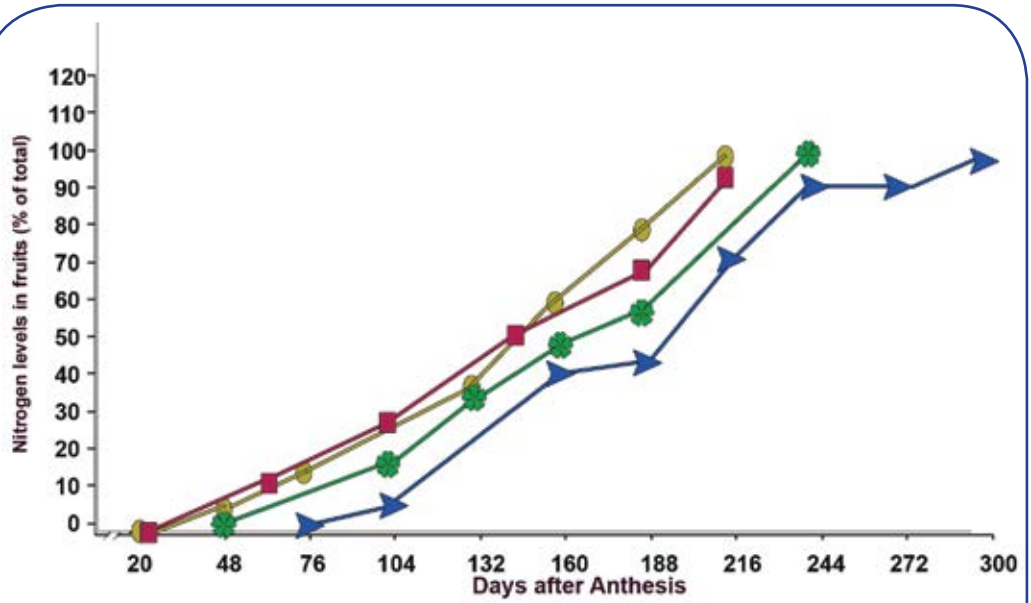

Figure One: *Dry matter accumulation in fruits (as a percentage of the cumulative total) of four genotypes (clones) of Conilon coffee, from anthesis to fruit maturity*

The experimental plot consisted of one plant from which one plagiotropic branch was extracted every 28 days, from flowering until fruit ripening. This was done in order to determine the levels of dry matter as well as the concentrations and accumulations of N, P, K, Ca, Mg and S in the fruits.

Fertilization management of different C. Canephora Conilon plants coffee genotypes should differ in accordance with the length of the cycle so as to supply plants at times of higher nutrient need

On average , each of the branches were seen to contain a total of thirteen rosettes with coffee fruits.

Sampling began in mid August 14, 20 days after anthesis for the early and intermediate genotypes *(12V and 10V)*, and in mid September for the late and very-late genotypes *(13V and Ipiranga 501)*.

Sixty-five uniform plagiotropic branches per genotype were previously and randomly marked, with five branches randomly removed and sampled at every 28 days. The sampling finished on March 6, April 8, May 7 and July 3, for the early, intermediate, late and very late genotypes, respectively.

The fruits were extracted and dried in a greenhouse with forced air circulation at 70°C until constant mass was obtained. Their dry matter was then determined on a 0.001 g precision scale.

The accumulation of nutrients in the fruits present on the branches was calculated considering the dry matter and the concentration of the respective nutrients. The percentage of accumulation at different seasons was then calculated, and the last collection was considered 100%, in which more than 80% of the fruits on the branches were fully ripe.

The data were subjected to regression analysis, and the mathematical models were chosen in accordance with the equations with the best fit, corroborated by the higher values for the coefficients of determination *(R2)* and by the significance of the regression coefficients and the regression F test *(0.05)*.

Results and discussion

The four genotypes *(clones)* of 'Conilon' coffee showed similar dry matter accumulation curves in fruits ***(See Figure One)***.

In all cases, the period of fruit formation presented sigmoidal behavior - an initial stage with less expressive accumulation rates, followed by a stage of rapid expansion and the highest rates, and a final stage with less expressive rates at the end of the cycle of fruit formation.

This behavior bears strong similarities to what has been previously observed in Arabica coffee plants whose trend curves showed sigmoidal *(S-shaped)* characteristics,

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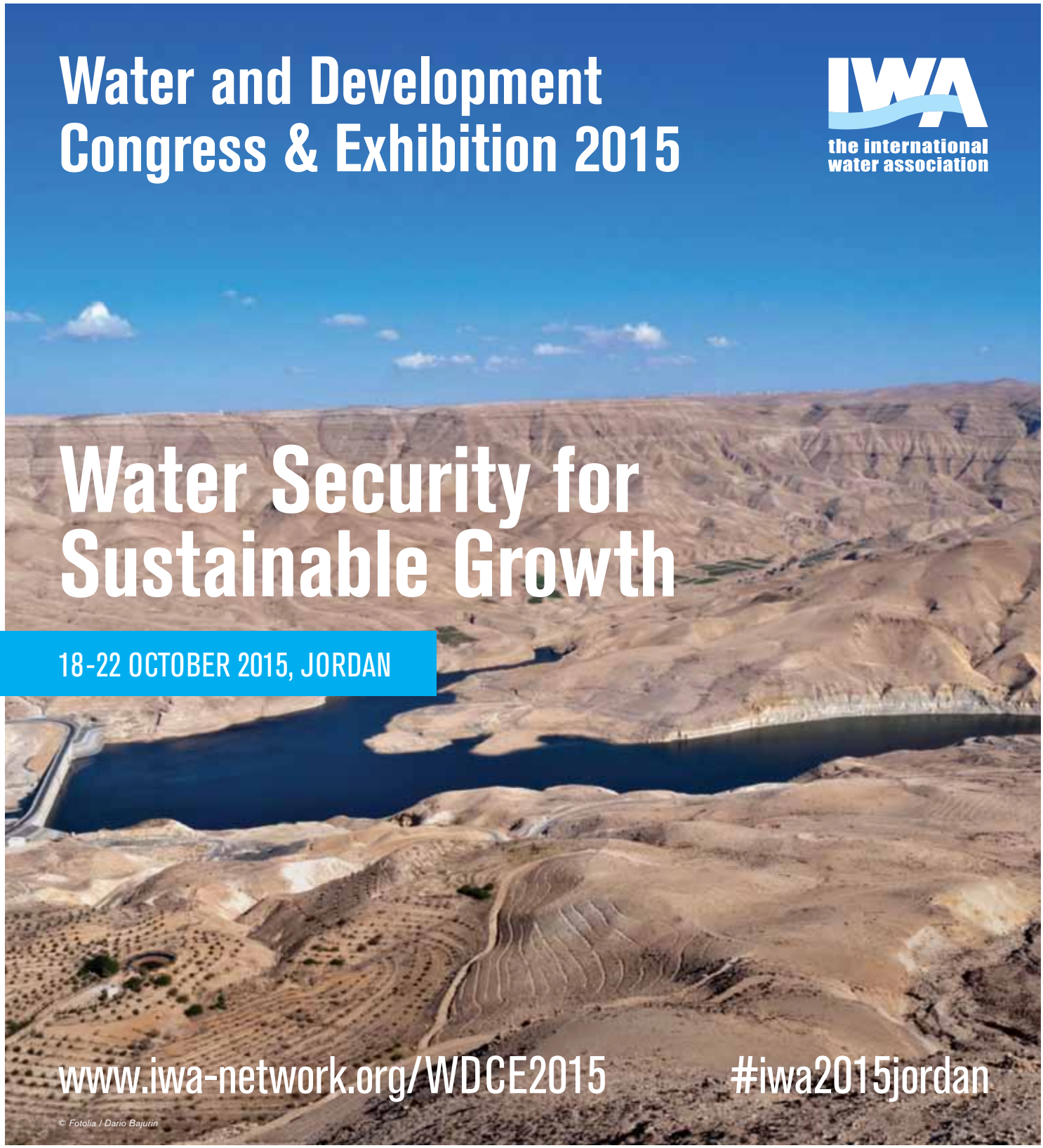

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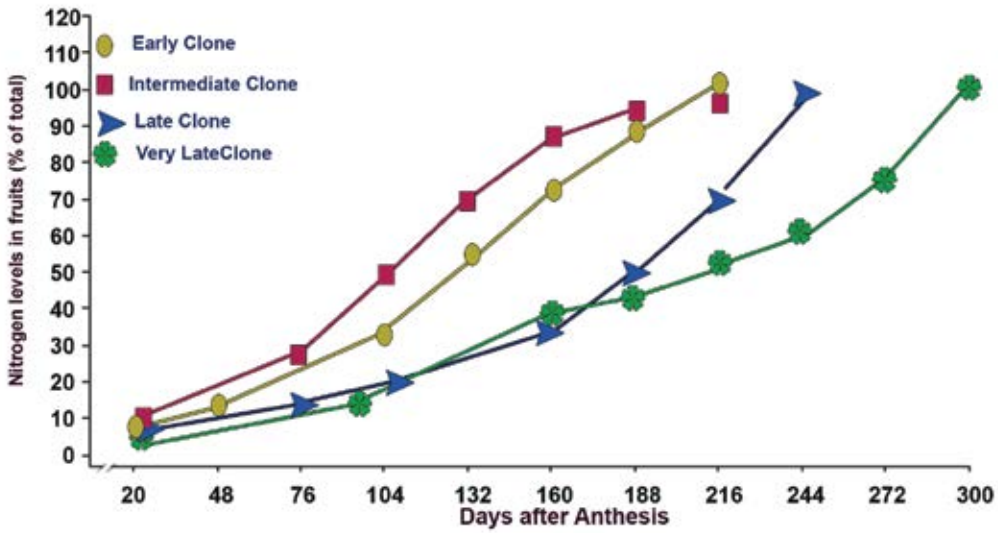

Figure Two: *Accumulation of nitrogen in fruits (in percentage of the cumulative total) of four genotypes (clones) of Conilon coffee, from anthesis to fruit maturation*

making it possible to identify the five different stages of fruit formation, which are the initial formation of fruitlets, rapid expansion, suspended growth and graining (or grain filling, all of which are related to this growth model.

The highest accumulation rates were found in the stages of rapid expansion, suspended growth and grain filling.

Recent surveys have shown similar results relating to nutrient accumulation in the cultivation of both potato cotton, finding which go a long way in reinforcing the practical relevance of this information for a variety of crops, as it shows that the information gathered can be directly associated with plant nutrient requirements and with it the consequent need for split application of fertilizer.

Although the genotypes presented similar behavior for accumulation rates, the duration of each stage were seen to differ, resulting in a 216 day growing cycle for the early genotype, a 244 day cycle for the intermediate and late genotypes, and a 300 day cycle for the very late genotype.

During the research it was observed noteworthy that, although the intermediate genotype presented cycle duration similar to the late genotype, the latter was harvested later as a result of the coffee plant's primary flowering taking place thirty days after the former.

Nitrogen accumulation in the fruits of the early and intermediate genotypes followed a trend similar to dry matter accumulation, with sigmoidal behavior. In contrast, the late and very late genotypes were observed to not follow the same pattern of dry matter accumulation and showed exponential curves ***(See Figure Two)***.

During the tests, it was observed that the behaviors of the late and very late genotypes suggest that there are differences within the same species that should be considered in the nutritional management of plants of these crops, inviting a suggestion that split application of fertilizer should be different depending on the genotype.

In accordance with the Ca accumulation curves, 70% of the Ca in the fruits of the early, intermediate, late and very late genotypes was accumulated up to 160, 170, 140 and 230 days after anthesis.

Accumulation in the first three genotypes was observed to be similar to that reported for C. Arabica Caturra in which 70% was accumulated by 120 days *(genotype with a maturation cycle of 240 days)*.

In addition , the behavior of the very-late genotype shows differences in the duration of the stages of fruit development since the highest rates of accumulation of Ca are related to cell wall formation and stabilization of membranes and occur in stages of rapid extension and suspended growth.

Ca is the second nutrient that is most accumulated by 'Conilon' coffee trees and, like Mg, it is usually provided by liming. Research suggests that the foliar application of calcium-based fertilizers at the time of higher requirement, to supply this high demand.

Conclusions

Genotypes 12V, 10V and 13V have similar curves of accumulation of dry matter, N, P, K, CA, Mg and S, while genotype Ipiranga, 501 differs from all three Genotypes with a shorter fruit ripening cycle have a higher rate of accumulation of dry matter and nutrients.

Fertilization management of different C. Canephora Conilon plants coffee genotypes should differ in accordance with the length of the cycle so as to supply plants at times of higher nutrient need.

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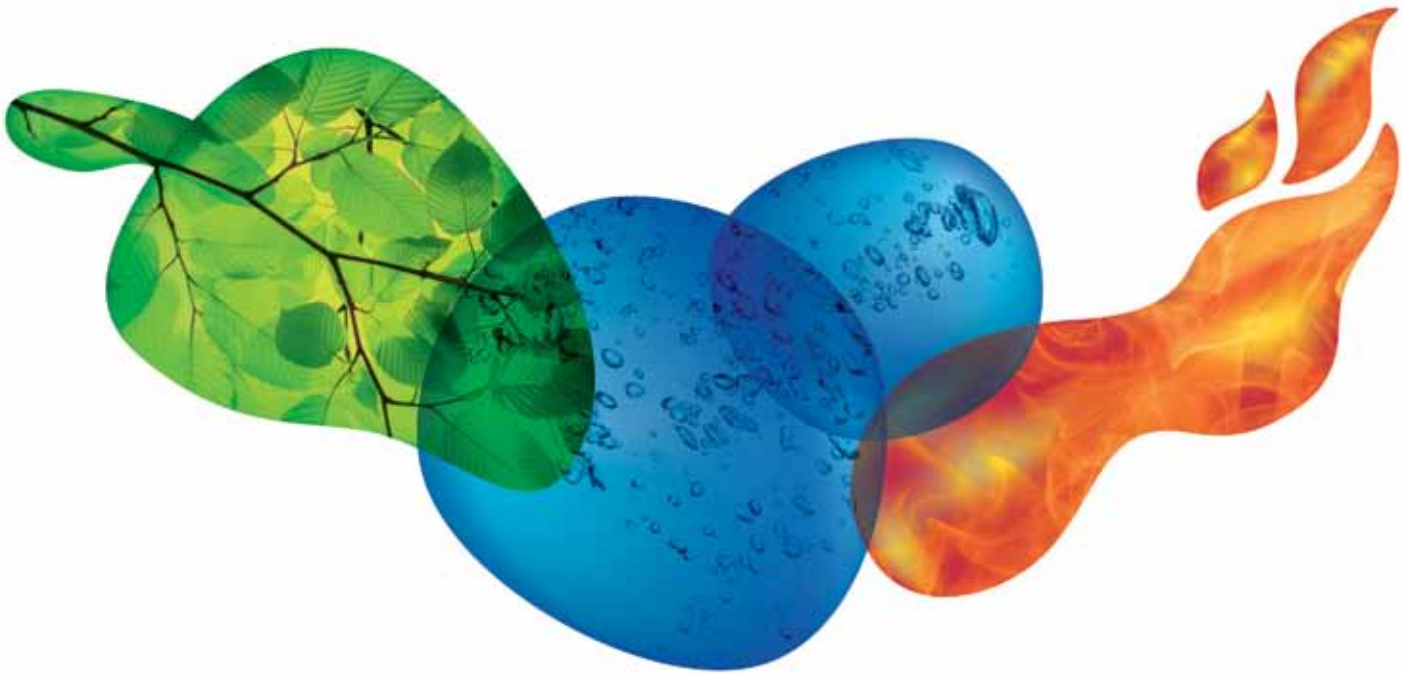

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Estimating soil moisture status in peach tree orchards through a crop water stress index

Introduction

Using thermal imaging in calculating crop water stress index (CWSI) has not been always considered an easy task, with the limitations of its use as a routine tool generally stemming from its high sensitivity to climate factors, among them radiation, wind speed, and humidity, coupled with the need to establish crop-specific non-water-stressed baselines for different agroclimate zones.

Using thermal imaging in calculating crop water stress index (CWSI) has not been always considered an easy task, with the limitations of its use as a routine tool generally stemming from its high sensitivity to climate factors

Statistical analysis has consistently revealed that the relationship between CWSI and leaf water potential (LWP) has been found to be more stable than the relation between canopy temperature and LWP with a defined spatial variability in each treatment being defined, some of which may be attributed to the difference between sunlit and shaded leaves.

Researchers have been known to use a variety of methods to determine soil moisture content *(SMC)* in orchards. Some of the methods employed have been found to be both time consuming and expensive due to the equipment density required by the soil spatial variability.

For that reason, less expensive methods need to be tried and used if found reliable, with, among others, the use of thermal images of tree leaves to determine *CWSI* in fruit cultivation.

In recent years, researchers in Romania, one of the major centers of fruit cultivation in Eastern Europe have been involved in the investigation of the best methods of establishing and calculating a crop water stress index and estimate soil moisture status in order to use the date accumulated for irrigation scheduling.

Material and Methods

A series of experiments were carried out over a typical summer growing season, at a Research Station situated in the Constanta region of Romania, located on the Black Sea coastline, at a latitude of 44º 05' North and longitude of 28º 37' East.

The experimentation was carried out in an orchard specializing in the the cultivation of peaches, which are grown on a wide scale across the region.

The studied field parcels comprised three adjacent fruit tree rows with the central row containing six trees for various measurements and observations, trained in a canopy shape, flattened in the row to allow traffic, and canopy volumes occupy all the space in the row.

The climate conditions at the semi-arid experimental site are characterized by a mean annual temperature *(Ta)* of 11.4°C and a mean annual precipitation *(P)* of 382 mm, not uniformly distributed across the year; reference evapotranspiration *(PM-ETo)* for the year of the test totaled 788 mm, with an average of 121, 137 and 124 mm per month-1 during the months of the test (*June, July and August, respectively* ***(See Tables 1a and 1b)***).

The relationship between soil water potential measured with the Watermark sensors and SMC measured gravimetrically, using previously determined from field data, with the established relationship was then applied to the soil water potential readings during the experiment in order to estimate SMC values, averaged over the normal active rooting depth of 80 cm.

The trial design was based on the two factors:
Factor A: taking in three irrigation regime treatments,
- T1-fully irrigated,
- T2-sustained deficit irrigated
- T3-control, non irrigated.

Factor B with three cardinal points:
- South,
- North
- East-West

The tree canopy was viewed by thermal images taken from a distance of 1.0-1.5 m and a height of 1.5 m perpendicular to the area being imaged towards the middle of the tree canopy.
The three irrigation regime treatment plots were situated at least 50 m apart from one another. Canopy width and height were approximately 2.5 m each, when coefficients of variation for T were calculated.

Results and Discussions

Crop water stress index values and their use in estimating soil moisture content
Soil moisture content - measured values
The profiles of SMC in the treatments studied during the three measurement occasions are depicted in ***Figure One***. The instant values of SMC have been encompassed between WP line and FC line, i.e. T1 mainly near MAD line, whereas T2 and T3 between MAD line and WP line, slowly decreasing with depth.
Fruit trees have been observed to react to water stress differently at such SMC values.
The large porous space between FC and TC is normally

used by the infiltrating water during irrigation application or precipitation events without causing water logging, runoff, or surface erosion.

Examples of soil physical characteristics as average values for the 0 - 80 cm depth for the three measurement standards used in the trial are as follows:

a) 27th July - the average SMC was 19.35% *(39% of the available SMC, or a corresponding soil matric potential - SMP of 76 kPa)* in T1; 18.20% *(32% of the available SMC, or 96 kPa)* in T2 and 16.40% *(22% of the available SMC, or 161 kPa)* in T3. SMC values were not much different from one another.

b) 7th August - the average SMC SMC was 21.05% *(49% of the available SMC, or a corresponding SMP of 53 kPa)* in T1; 16.7% *(24% of the available SMC, or 142 kPa)* in T2 and 15.10% *(15% of the available SMC, or*

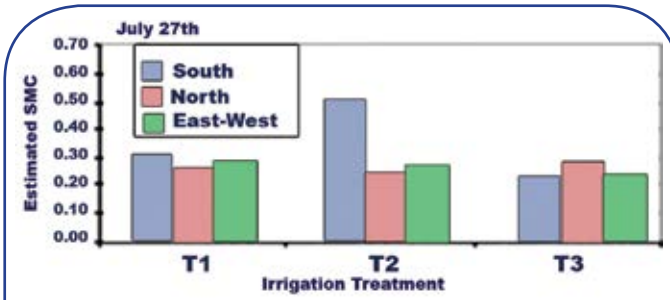

Figure One: *Crop water stress index (CWSI) for peach as: sunlit (South), shady (North) and average (East-West) and using thermal images taken in late July of the irrigation treatments*

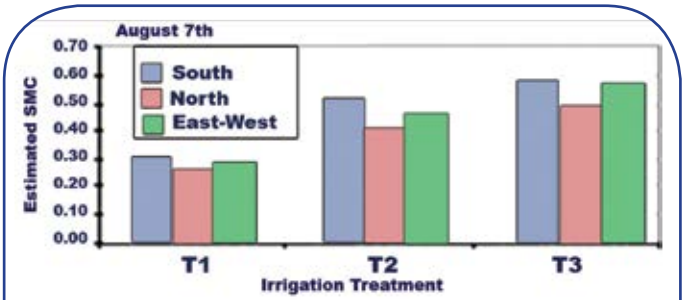

Figure Two: *Crop water stress index (CWSI) for peach as: sunlit (South), shady (North) and average (East-West) and using thermal images taken in early August of the irrigation treatments*

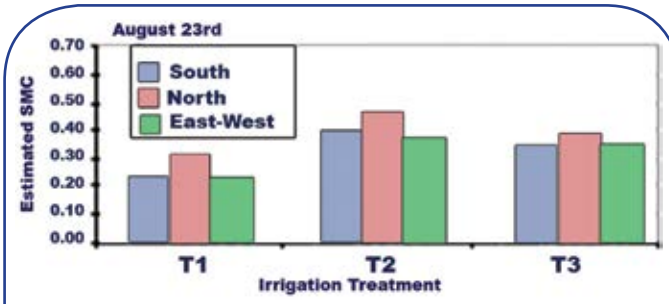

Figure Three: *Crop water stress index (CWSI) for peach as: sunlit (South), shady (North) and average (East-West) and using thermal images taken in late August of the irrigation treatments.*

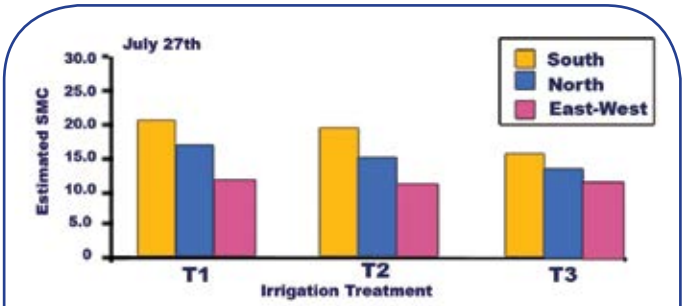

Figure Four: *Soil moisture content (SMC) as average values over 0 - 80 cm depth for peach as: sunlit (South), shady (North) and average (East-West) and using thermal images taken in taken in late July of the irrigation treatments*

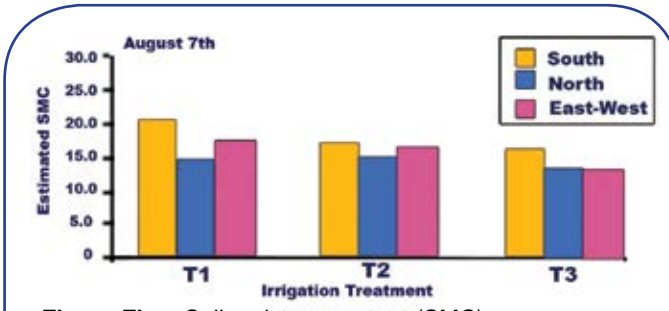

Figure Five: *Soil moisture content (SMC) as average values over 0 - 80 cm depth for peach as: sunlit (South), shady (North) and average (East-West) and using thermal images taken in taken in early August of the irrigation treatments*

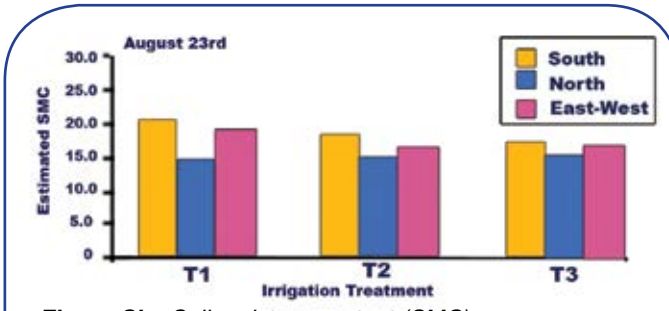

Figure Six: *Soil moisture content (SMC) as average values over 0 - 80 cm depth for peach as: sunlit (South), shady (North) and average (East-West) and using thermal images taken in taken in late August of the irrigation treatments*

Table One: Average monthly values of air temperature (T) Evapotanspiration (Eto) Preticipation (P) and climatic water deficit (WD) for previous fifty years

Month	One	Two	Three	Four	Five	Six	Seven	Eight	Nine	Ten	Eleven	Twelve	Average
T	0.13	1.28	4.51	9.63	15.28	19.65	22.06	21.89	18.14	13.13	7.83	2.82	11.36
Eto	16.3	20.8	35.2	57.9	95.4	121.0	136.8	123.9	85.2	52.3	26.0	17.0	787.5
P	29.0	26.0	34.7	27.3	39.0	41.0	30.0	32.0	33.7	33.0	31.0	25.5	382.2
WD	12.7	5.2	-0.5	-56.4	-56.4	-80.0	-106.8	-91.9	-51.5	-19.3	5.0	8.6	-405.5

Table Two: Average monthly values of air temperature (T) Evapotanspiration (Eto) Preticipation (P) and climatic water deficit (WD) during test year

Month	One	Two	Three	Four	Five	Six	Seven	Eight	Nine	Ten	Eleven	Twelve	Average
T	-0.6	-2.8	6.0	13.5	18.6	22.9	26.2	24.5	20.0	16.0	9.1	1.0	12.9
Eto	11.2	18.0	50.6	92.8	115.5	162.7	166.6	128.0	83.0	46.9	18.3	10.0	903.8
P	71.6	11,4	11.9	24.6	110.3	3.6	10.4	22.80	5.9	33.0	16.2	69.7	391.4
WD	60.4	-6.6	-38.7	-68.2	-5.2	-159.1	-156.2	-105.2	-77.1	-13.9	-2.1	59.7	-512.2

200 kPa) in T3. SMC values were obviously different between treatments.

c) 23 August - the average SMC SMC was 20.10% *(43% of the available SMC, or a corresponding SMP of 69 kPa)* in T1; 15.50% *(17% of the available SMC, or 187 kPa)* in T2 and 14.60% *(12% of the available SMC, or over 200 kPa - beyond measuring range)* in T3. Both T2 and T3 showed the lowest SMC values.

Crop water stress index

The values of CWSI for the three occasions are shown in ***Figure Two***.

On the first occasion CWSI was more or less similar in T1 - T3 irrigation regime treatments, around 0.3, reflecting the closeness between SMC values.

In the other two occasions CWSI values showed a larger range, e.g. from about 0.3 in T1 *(mild water stress)* to about 0.6 in T3 *(severe stress)* during the 7th of August, while a similar situation occurred on 23 August, however with a smaller difference in CWSI.

According to the chemical reaction formula utilized, it was observed that nitrogen compounds can be consumed by algae during photosynthesis

Estimation of soil moisture content

Estimates of SMC as mean values over the 0 - 80 cm depth obtained with the help of CWSI from each central point are shown in ***Figure Three***.

As expected, SMC was higher in T1 and decreased in T2 and T3, from about 18-20% to around 15% of volume.

In general, SMC estimates were seen to be higher for the South direction when compared to the North, while SMC for East-West showed intermediate values.

In irrigation scheduling the moment of water application is established according to various methods, one of them being SMC values that are laborious to determine, or SMC can be derived or estimated by help of other techniques.

Conclusions

The results recommend the spatial characteristics used in this experiment: 1.5 m for height and 1.0-1.5 m for distance from the peach trees for taking thermal images could well be highly beneficial in irrigation scheduling.

The values of crop water stress index *(CWSI)* for the three principal test configurations ranged in the irrigation regime treatments from around 0.3 for the first measuring occasion and mild water stress to about 0.6 in non-irrigation treatment showing severe stress.

Estimates of SMC as mean values over the 0-80 cm depth obtained with the help of CWSI from each principal point showed that SMC was higher in fully irrigated treatment and decreased in the stressed treatments.

SMC estimates were observed to be higher for the South direction versus North, and SMC for East- West showed intermediate values.

The standard errors of the estimate - SEE between measured and estimated SMC values ranges from 1.7 to about 2.2%, or being 6-7% versus the field capacity and 10-12% versus the available soil water capacity (ASWC).

The values reviewed in this test only show the approximate size of soil-water status, because a variety of causes were attributed to be responsible for these differences. ■

Show Preview

Turkey's Water And Wastewater Market's Future Is As Bright As Water With 82 Billion Usd New Investments

IWE ISTANBUL WATER EXPO 03 - 05 September 2015

Organized by the world's one of the leading trade fair organiser ITE Group Plc's Turkey office EUF, IWE Istanbul Water Expo will be held from 03-05 September 2015 at Istanbul Expo Center with the support of Republic of Turkey Ministry of Forestry and Water Affairs, General Directorate of State Hydraulic Works, Istanbul Metropolitan Municipality, Istanbul Water and Sewerage Administration, UCLG MEWA, Turkish Water Foundation and National Research Center on Membrane Technologies. IWE Istanbul Water Expo will bring together a comprehensive range of the latest technologies and developments in sustainable utilization of water resources, water saving, wastewater treatment and water reuse on the same platform.

According to Frost & Sullivan's research, Turkey's water and wastewater market is on the threshold of significant growth. To conform Turkey's EU environmental legislation in the framework of EU conformity laws stated that about $82,2 billion investment is needed in the years 2007-2023. 80% of this investment is expected to be implemented by the public, while the remainder is expected to be implemented by the private sector.

Frost & Sullivan estimates for water market in Turkey;

- Developing the improved water resources management, sustainability and smart infrastructure spread the provision of energy-saving technologies with the integrated solutions and services.
- Wastewater treatment sector in the urban and industry showing the highest growth potential. Advanced wastewater technologies will grow at a higher level, especially in areas with sensitive water reserves.
- Increased industrialization and urban services will increase the growth of advanced technologies such as filtration and disinfection and sludge treatment technologies will gain great importance.

Turkey has strong historical, cultural and economic ties with the neighbouring countries of Eastern Europe, the Balkans, the CIS, the Middle East, Central Asia and Africa. IWE Istanbul Water Expo will be a great opportunity to expand into surrounding countries through Turkey as a hub.

Water and wastewater treatment, water storage, distribution and sewers, reuse of water, all the necessary technology, systems and equipments for process control and automation will be showcased at IWE.

IWE's concurrently held Smart Water Conference will bring together the decisionmakers of governmental and private institutions to discuss solid business and partnership opportunities.

Contact Tulin Bozkurt Bulut – Event Director
tulin.bozkurt@ite-turkey.com
www.istanbulwaterexpo.com ■

Examining the performance of turfgrass planted on "green roofs" under different irrigation regimes

Introduction

It has become a well established fact that green roof technology comes with a number of environmental and aesthetic benefits.

These benefits include noise, temperature and solar irradiance reduction, grading of rainstorm water distribution and improvement of the aesthetic quality of the urban environment.

However, several of these advantages such as storm water management and amelioration of the urban heat island effect are feasible only if green roofs are implemented in adequately large scales

Despite the worldwide acceptance of green roof benefits, their application has been hindered in several countries, mostly due to rigid construction guidelines.

More specifically, green roof technology has been mainly implied in countries that provide either direct compensation or indirect economical savings, in particular, tax advantages.
Despite these benefits green roof application has been almost entirely stagnant in countries where the government provides little or nothing in the way of incentives.

Turfgrasses can provide a viable solution for green roofing since they posse a unique ability to serve all of the three urban plant requirements, namely aesthetics, functionality and even a place to not only relax, but enjoy some forms of sport and recreation.

Based on existing guidelines for green roof construction in most countries , the use of turfgrasses in green roofing has been limited where limited load bearing capacity is a factor.

To reach further understanding of the advantages of using turfgrasses on adaptive green roof systems, recent research has been carried out on to best utilize the shallow substrate depth of extensive green roofs (either 7.5 cm or 15 cm) while combining them with irrigation to support turfgrass growth.

Researchers investigating choices of green roof substrate have generally reached the conclusion that substrate depth was indeed a significant factor, although the use of efficient irrigation would be capable of compensating for its reduction.

Researchers investigating choices of green roof substrate have generally reached the conclusion that substrate depth was indeed a significant factor, although the use of efficient irrigation would be capable of compensating for its reduction

This discovery is expected to allow for the use of lightweight green roof construction, which can readily be be utilized as outdoor recreational areas and contribute to the beneficial urban green network.

In recent months, a series of studies have been carried out to determine the evapotranspiration (Evo) and drought tolerance of turfgrass species when grown in green roof systems under different substrate depths and irrigation regimes to ascertain the following:

a) Whether the drought tolerance of Turfgrass is liable to improve as depth and irrigation increases;

b) Whether increasing irrigation levels would compensate

Table One: Physical characteristics of the phosphate used in the tests.

Measurement	Unit
Dry Bulk Density	0.79 gram per cubic centimeter
Saturated Bulk Density	1.36 gram per cubic centimeter
Total Porosity	54.00%
Readily Available Water	12.60%

for reduced substrate depth;

c) Whether reduction of a irrigation regime and substrate depth would impact Evo through turfgrass growth.

The results from such investigation were expected to be invaluable in providing a decision making tool that will support the necessary flexibility for green roof construction in the semi-arid regions of the Mediterranean.

The investigation was carried out in two steps, the first, over a short term, was performed over a short term, during the heat of a Mediterranean summer, between from 29 July until 22 August, with the second study performed during late spring to summer, the 4th of May until 19 July the following year.

The purpose of the study was to establish two factors, the first being the feasability of different green roof substrate depths- either 7.5 cm or 15 cm. with the second factor being to compare between two irrigation regimes, either high or low level.

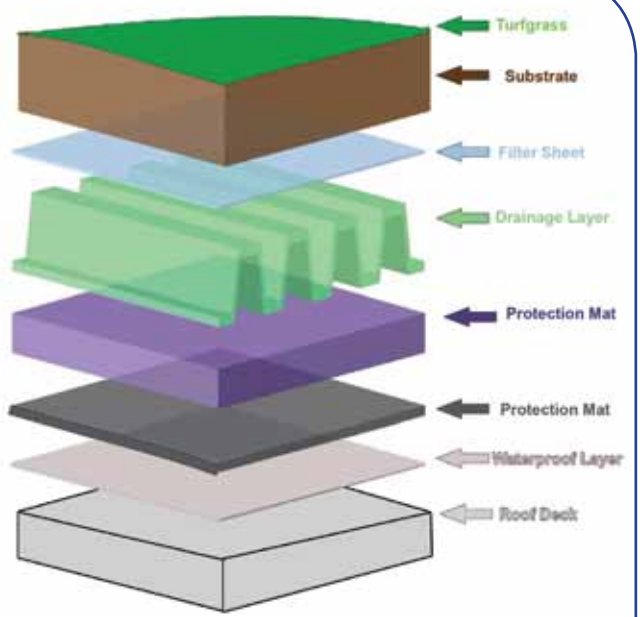

Figure One: *Layers involved in the construction of a green roof with Turfgrass*

These permutations were carried as follows:

Two sub depths, either 7.5 cm or 15 cm, and two irrigation regimes, high or low level, with the researchers replicating the tests three times, for a total of twelve. Each of the tests were regulated using lysimeters, a measuring device which can be used to measure the amount of actual EVo in a plant . While the lysimeter is generally used to measure EVo released by crops or trees, it was found to be equally effective in recording the amount of precipitation that an area of turfgrass receives as well as the amount lost through EVo, making it a simple process for the amount of water lost to evapotranspiration to be calculated.

Green roof construction within the lysimeters

The twelve outdoor lysimeters used during the investigation were placed within an internal diameter of 30 cm, within a complete layered simulation of an extensive green roof system was constructed ***(See Figure One)***.

The drainage layer, made of recycled polyethylene, 25 mm high and weighing 1.5 kg per square meter, with water retaining troughs and openings for ventilation was placed, over the protection mat, made from a non-woven geotextile, made up from thermally strengthened polypropylene, having a thickness of 600 micrometers. The purpose of the filter sheet was to prevent fine particles migrating from the substrate towards the drainage layer to ensure that the drainage layer would not clog.

Materials and Methods

All of the lysimeters used in the trial were filled with a specialized green roof substrate based on pumice. The physical properties of the substrate are provided in ***Table One***.

Half of the lysimeters were used to measure the substrate depth at a depth of 7.5 cm and a mass of 4.30 kilograms while the other half reached a depth of 15 cm and a depth of 8.50 kilograms.

Measurement procedures

Moisture content of the substrate was determined daily, just before the irrigation of the turfgrass using a dielectric moisture sensor, which determine the soil moisture by measuring the dielectric constant.

Measurements in substrate profiles with different depth were achieved by inter changing the sensor rods, with the sensor rod length being 7.5 cm and 12 cm for the lysimeters with substrate heights of 7.5 and 15.0 cm respectively.

The spectral reflectance of the canopy was determined from each lysimeter before each irrigation event between 12:00

Turfgrass planted on a green roof

and 14:00 using two double-channel SKR 1800 sensors; one placed facing d upwards with a light correcting cosine diffuser to collect the incident solar spectra, and the other facing downwards to collect the reflected spectra.
The sensors were connected to a display meter and mounted on a telescopic hand-held pole.

Irrigation regime
From the initiation of the deficient irrigation treatments all of the lysimeters were irrigated close to saturation in order to ensure uniform substrate moisture conditions at the initiation of the study. From this point onwards, irrigation was carried out on a daily basis, according to levels of evaporation, measured through the use of a Class-A Pan.

Turfgrass maintenance
Turfgrass sward was mowed at a height of five centimeters once weekly Fertilization was applied once before the Evo levels determined for each treatment by weighing the lysimeters with an S-type load cell connected to a digital indicator in conjunction with the determination on of water inputs and outputs.

Lysimeter weighing was performed daily before irrigation.

Results and Discussion

In both of the studies, the substrate moisture content displayed a reduction that was seen to be more precipitous at the initiation of the irrigation treatments ***(See Figures Two and Three)***.

Differences between the two irrigation regimes 85 and 65 % ETo were more pronounced in comparison with the substrate depth treatment. In both study years the moisture of the shallow substrate depth was increased compared with the deeper substrates, which is in contrast to previous research on growing turfgrass on green roof, although they did substantiate the theory that deeper profiles retained higher moisture content, although these findings were reached where water applications were spaced three days apart.

Where irrigation scheduling took place on a daily basis, it was found that the same amount of water was distributed more rapidly and decreased more abruptly at the low irrigation regime (65% ETo) and the shallow substrate profiles (7.5 cm) in both study years.

Conclusions

The observed differences between treatments influenced cumulative Evo during the first study year, when temperatures and with it evaporation was much higher, with irrigation at 85 % of the level of ETo exhibiting the effects of higher evapotranspiration compared with 65 % ETo only after 20 days of water stress imposition had passed, while the differences between the two substrate depths were found to be insignificant.

During water stress periods turfgrass can grow and even thrive on extensive green roof systems provided irrigation is no less than 85% of ETo.

In addition it was observed that substrate depth can be comfortably reduced from 15 cm to 7.5 cm without significantly stressing the turfgrass plants, based on findings that evapotranspiration depends on the applied irrigation regime and not on the substrate depth. ■

During water stress periods turfgrass can grow and even thrive on extensive green roof systems provided irrigation is no less than 85% of ET

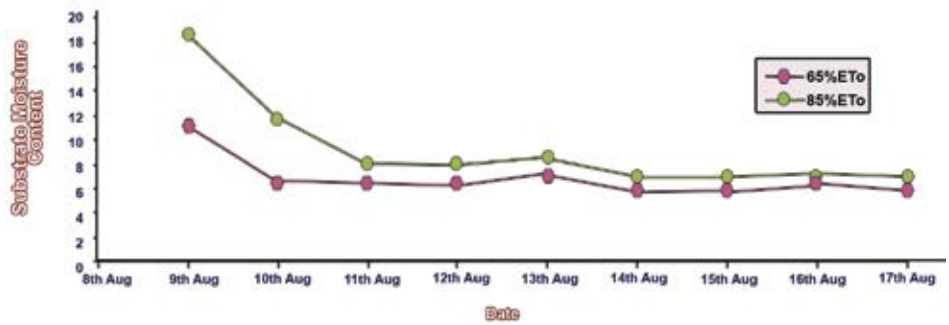

Figure Two: *Volumetric water content as affected by irrigation regime (85 or 65% ET) during the first study year*

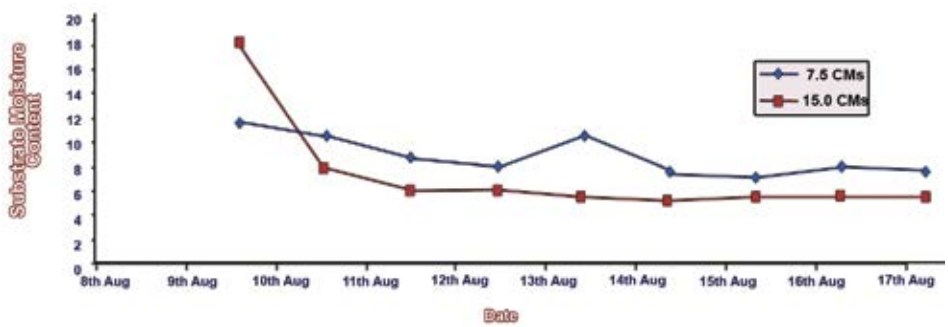

Figure Three: *Volumetric water content as affected by substrate depth (7.5 or 15.0 cm) during the first study year*

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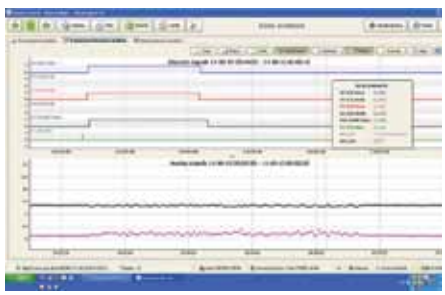

- The SPOT - Complete operational control through a web based program from everywhere and without installation.

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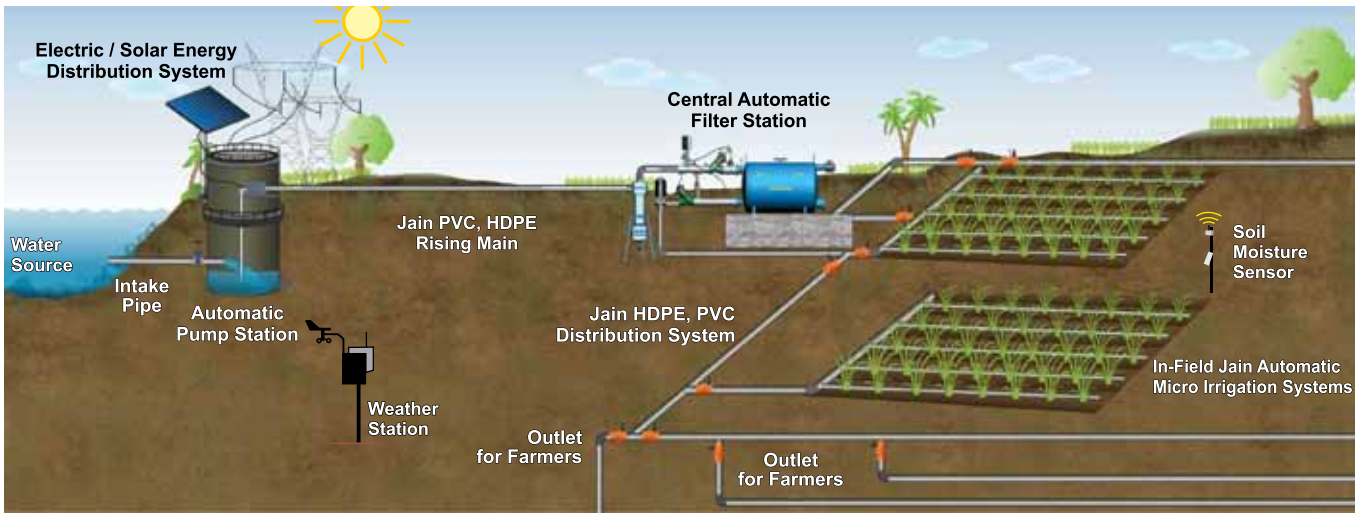

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