GREENHOUSE GROWING - HIGH REWARDS FROM HIGH-CLASS CROP NUTRITION

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Rewards from greenhouse crops are potentially high but are only realised if nutrient inputs match the needs of crops grown in controlled environments. Closed conditions and 'closeted crops' inside greenhouses are completely independent of what goes on outside, whether low light and temperature in cool temperate Europe or hot and dry arid and semi-arid conditions experienced throughout much of the Middle East.

Newly-germinated cucumber seedlings, still at the cotyledon-leaf stage, prone to damping off and therefore benefitting from applications of Omex Nami (Bio 20) to boost growth and resilience (Picture Dr Terry Mabbett)

Controlled environments make multiple cropping a reality allowing growers to capitalise and 'cash in' on overseas markets when fresh food prices are high. Middle Eastern growers concentrate on salad crops such as tomato, cucumber, pepper, aubergine and lettuce, relatively short-cycle crops ideal for continuous cropping and for which there is always a market.

Rapid growth and early maturation to achieve the maximum number of crops and year-round availability of produce requires finely-tuned crop nutrition. The high quality of nutrients is clearly important but the facility to use completely water-soluble formulations (delivery systems) by foliar feeding is an equally overriding requirement.

Foliar feeding is a key component of greenhouse growing in the Middle East. High-sand soils in Saudi Arabia and elsewhere frequently fail to maintain a sufficient supply of essential plant nutrients in a plant available form given the inherently low organic matter contents of many 'native' soils.

Newly-germinated cucumber plants with seed coats still attached to the cotyledon leaves (Picture Dr Terry Mabbett)

Foliar feeding allows growers to 'pick and choose' which nutrients are applied, the concentrations and quantities used, and the exact timing in relation to specific stages in the crop cycle. Essentially it will not matter what's happening at soil level, because foliar feeding secures rapid and unimpeded entry of nutrients in a completely water-soluble form via the leaves and into the plant for cellular utilisation.

Secret of success for greenhouse-grown salad crops is identifying nutrient needs in relation to particular stages of crop development such as flowering and fruit formation and predicting potential nutrient 'bottlenecks' which may individually impact on the entire crop cycle.

So exactly what are the typical plant nutrition requirements for rapid unimpeded production of high quality salad crops under controlled greenhouse conditions? To find out more I spoke with Peter Prentis Managing Director of Omex Agrifluids, a globally-active research and development based company with corporate headquarters, research facilities and manufacturing capacity at Kings Lynn, eastern England in the United Kingdom.

Cucumber seedlings now established with two true leaves (Picture Dr Terry Mabbett)

Omex Agrifluids specialises in the manufacture and marketing of high quality plant nutrients formulated in high-end delivery systems, both soluble liquids and soluble powders, for application by foliar spraying (foliar feeding). Peter Prentis' remit and responsibility covers research, development and marketing of the full range of Omex soluble nutrient products across Europe, the Middle East and Asia.

Tomato seedlings having just pushed through the soil, prone to damping off and therefore benefitting from applications Omex Nami (Bio 20) to boost growth and resilience (Picture Dr Terry Mabbett)

Omex spans the Middle East

Omex Agrifluids has a long-established business record in Saudi Arabia supplying greenhouse growers with their crop nutrition needs. "We have been working in Saudi Arabia for many years through our distributor Al-Yaseen Agricultural Company. More recently Omex has expanded its interests into the wider Middle Eastern, North African and Mediterranean arena. We now supply top-quality, liquid formulations of high-purity, water-soluble nutrients for application by foliar spraying to farmers and growers throughout this entire region, and now a world hub for the production of fruit and vegetables, outdoors and indoors under various levels of protection," says Peter.

A well-established tomato seedling with three true leaves (Picture Dr Terry Mabbett)

Crowded seedlings in the nursery seedbed are highly prone to damping off – Scotch bonnet hot pepper is shown here (Picture Dr Terry Mabbett)

Peter told Arab World Agribusiness how Omex has designed and developed a wide range of soluble nutrient formulations high in purity and completely soluble in water. "Omex products sold by Al-Yaseen Agricultural Company reflect a focus on greenhouse growing and the specific requirements of the mainly salad crops grown.

The four products are: Omex Nami (Bio 20), Omex Combi (Micromax), Omex Calmax and Omex DP98.

Off to a flying start with Omex Nami (Bio 20)

Good seed germination and unimpeded seedling establishment in crowded seed beds followed by transplanting out and associated 'transplant shock' are times when salad crops like tomato are at their most vulnerable.

Crowded seedlings in the nursery seedbed are highly prone to damping off – radish is shown here (Picture Dr Terry Mabbett)

Anything which prevents smooth passage through this potentially tricky period may lead to plants with a weakened growth and metabolism and carried right through the crop cycle to be reflected in poor yield and crop quality. What's more crop maturation and harvest date may be delayed with growers missing out on marketing periods when produce prices are highest. I asked Peter Prentis if Omex Agrifluids had any products dedicated to delivering young plants safely through this unpredictable period of growth and development.

"Indeed we do in Omex Nami (Bio 20) containing a complete profile and package of macronutrients and micronutrients. And boosted by humic acid which is a dual soil amelioration and plant biostimulatory product acting at the root zone and via plant metabolism," says Peter Prentis

Omex Nami (Bio 20) is applied as a foliar spray at the seedling establishment stage to promote root growth and development thus maximising uptake and utilisation of water and nutrients. "Root systems form the very foundation of plant anchorage and subsequent stability for the uptake of water-soluble nutrients via the root hairs. The uniquely effective nutrient-supply/biostimulant-boost format of Omex Nami (Bio 20) ensures the crop, whether tomato, cucumber or lettuce, gets off to a flying start. Such assistance is especially important for seed germination and seedling establishment. Early

Mixed-salad leaves are increasingly popular in European markets (Picture Dr Terry Mabbett)

stage crops will invariably encounter stress from abiotic environmental factors such as high temperature and low moisture or biotic factors in the form of pests and pathogens", says Peter.

I asked Peter Prentis about the range of pest and pathogen problems of seedling plants faced by greenhouse crops like tomato in Saudi Arabia and elsewhere in the region. "Ubiquitous and terminally damaging in this respect is plant parasitic nematodes which inhabit the soil, move into the rhizosphere (root zone) and invade plant roots. Meloidogyne (root knot nematode) is by far the most frequent and damaging nematode in Saudi Arabia," says Peter Prentis.

Unusual but effective combination – aubergine and tomato grown together in greenhouse cultivation (Picture courtesy Omex)

There are over sixty different species of Meloidogyne (root knot nematode) worldwide but for tomato and other greenhouse crops in Saudi Arabia Meloidogyne javanica and to a lesser extent M. incognita tend to be the most damaging. Highly susceptible tomato crops grown under warm conditions and on light sandy soils, which facilitate movement of the free living juveniles, are ripe for nematode invasion and development and suffer correspondingly high crop damage levels.

Peter points out how the loose, friable and sandy soils typical of Saudi Arabia is key to success of these pests by allowing 'free' movement of free-living, motile juveniles into the root zone. "Rapid estab-

Greenhouse-grown lettuce will provide a crop in as little as 3 to 4 weeks (Picture courtesy Omex)

lishment of strong and secure root systems by using Omex Nami (Bio 20) will go a long way to counteract the effects of these microscopic round worms," says Peter.

Another ubiquitous problem for seedlings irrespective of plant species is fungal-inspired 'damping off' disease festering on soft, young plant growth in crowded seedbeds and thriving on high humidity and leaf surface wetness.

These soil-borne fungal pathogens target and infect plants at different times in the seed germination and seedling establishment process to cause distinct pre-emergence and post-emergence phases of damping off.

Growers who follow a well-structured programme of foliar feeding can expect superb crops of tomato like the plum tomato shown here (Picture courtesy Omex)

In the pre-emergence phase seedlings are infected and killed just before they reach the soil surface. Pre-emergence damping off is due to the rapid death of the radicle (first root) and the plumule (first shoot) with a complete rotting of seedlings. Post-emergence phase is characterised by infection of the collar (junction between root and shoot) at soil surface level. The infected tissue becomes soft and water soaked and affected seedlings topple over or collapse, hence the name 'damping off'.

Damping off disease is caused by multiple pathogens, including fungus-like Phytophthora and Pythium and true fungi such as Rhizoctoni and Fusarium. "Omex Nami (Bio 20) applied during this early stage generates stronger seedlings with more robust shoots and stems to help young plants avoid or overcome damping off disease," says Peter. DP98 is used in other countries where it is recognised to reduce seedling mortality rates from damping off.

Growers who follow a well-structured programme of foliar feeding can expect superb crops of tomato like the cherry tomato shown here (Picture courtesy Omex)

Omex Combi (Micromax) feeds fast foliar growth

Plants taken out of the nursery bed and transplanted into their final positions are poised to take off with fast foliar growth and fuelled by an 'unquenchable thirst' for nutrients, but thwarted on two counts relating to the plants' root status and plant availability of nutrients in the soil.

Transplanted seedlings now shorn of root hairs are in a state of 'shock' and unable to indulge in the unimpeded uptake of water and nutrients until a new complement of root hairs is grown. "At no other time will plants benefit more from foliar feeding with Omex Combi (Micromax) offering a complete range of essential micronutrients in a chelated form," says Peter Prentis.

Root hairs have been renewed and rapid plant growth is underway but other problems now related to specific soil nutrient shortfalls may 'kick in'. "Periods of particularly rapid growth are the times when shortfalls of particular nutrients are most likely to occur and show up as nutrient deficiency symptoms. It is worth remembering that the speed and success of overall crop plant growth and development is dictated by the nutrient which is in least supply," says Peter Prentis.

Capsicum sweet peppers respond well to foliar feeding under greenhouse cultivation (Picture courtesy Omex)

Nutrient deficiencies frequently occur when soil-based nutrients are plant unavailable having become 'locked up' through interactions with other elements, often caused by prevailing soil pH (acidity/alkalinity) with zinc a case in point. Uptake of moderately mobile zinc ions is generally inhibited by alkaline soil conditions and specifically by soil phosphate interacting with zinc to form insoluble zinc phosphate. Similarly iron may be present in soils in considerable quantities but unavailable to growing plants due to high soil pH which generally prevails in the calcareous soils of Middle Eastern and Mediterranean basin countries.

I asked Peter how continued applications of Omex Combi (Micromax) could help in such situations. "Omex Combi (Micromax) has a full complement of chelated micronutrients. Routine application of Omex Combi (Micromax) as a foliar spray overrides limited plant availability of soil nutrients. Omex Combi (Micromax) is used on the broadest spectrum of greenhouse crops including tomato, capsicum peppers, aubergines, cucurbits, lettuce, brassicas, peas and beans and grapes," says Peter Prentis.

Uniform crop growth is one particular benefit of foliar feeding under the controlled environmental conditions of the greenhouse, as exemplified by the cucumber crop shown here (Picture courtesy Omex)

Omex Calmax and Omex DP98 working in unison

Omex Calmax and Omex DP98 are considered together because this is how they are increasingly applied and operate on the leaf surface and inside the plant. This combination frequently comes into action and play during later stages of the crop cycle to ensure sufficient calcium for strength and quality of harvested produce. Omex Calmax supplies the calcium while Omex DP98 provides phosphite ions to 'carry' the inherently immobile calcium ions into the plant.

Ensuring crops can access enough calcium is one of the biggest constraints confronting growers even on calcareous soils which ironically, as the name suggests, are potentially high in calcium. 'Potentially' is the 'key' word here, because even with high soil calcium levels plant roots and vascular systems will face extreme difficulty in accessing, absorbing and delivering calcium because the ion is poorly mobile.

However, this is only part of the problem because when 'calcium meets phosphorous' insoluble calcium phosphate is formed. "In these commonly-occurring situations Omex Calmax comes into play and shows its strength as a foliar spray by furnishing the plant with soluble and therefore plant available calcium," says Peter Prentis.

Peter adds how benefits accruing from foliar applications of Omex Calmax are boosted by using the product in tandem with the phosphite-containing Omex DP98. "This is achieved by tank mixing Omex Calmax and Omex DP98. The phosphite in DP98 'ferries' calcium into the plant, swiftly, safely and securely via absorption through the leaves," says Peter

Sandy friable soils of Saudi Arabia are ideal for activity of the root knot nematode, with devastating results especially for tomato as shown here (Picture courtesy Omex)

Calcium deficiency is the primary cause of blossom end rot in tomato (Picture Dr Terry Mabbett)

Calcium as calcium pectate cements the walls of adjoining cells together to form strong and rigid plant tissues. Any shortfall in calcium will correspondingly show up as tissue structure-related deficiency symptoms. Blossom end rot (tomato, capsicum pepper, aubergine and cucumber), bitter pit (apples and pears), tip burn (lettuce) and internal browning (potato tubers) are some of the most frequently occurring and best known effects of insufficient plant available calcium. Symptoms such as blossom end rot with a shortfall in calcium as the primary cause may become associated with plant pathogens. The reduction in calcium mobility under high temperature conditions is well known and Saudi Arabian growers will typically specify the application of Omex Calmax to overcome such temperature-related constraints on calcium availability.

Omex will be attending the Saudi Agriculture Show 21-24 October 2019 to support their Saudi Arabian distributor, Al-Yaseen Agricultural Company. Omex Managing Director Peter Prentis will be pleased to meet visitors on the Al-Yaseen Agricultural Company Stand – No 435-1.

Circle 28 on enquiry card

Blossom end rot of tomato initially caused by calcium deficiency can be subsequently invaded by a range of fungal pathogens to put the crop at further risk (Picture Dr Terry Mabbett)