Improving the quality of young tomato plants – PART 2

Uniformity of young plant development
Seed quality and substrate design

Grodan is once again happy to share its knowledge to support the Australian greenhouse industry. In the second of four articles for Practical Hydroponics & Greenhouses, Grodan® Crop Consultant and young plant specialist HANS VAN HERK provides an insight into the world of hi-tech tomato propagation and describes the importance of uniformity along the value chain and its impact for Australian greenhouse production.

Uniformity
Uniformity in greenhouse production is a fundamental requirement. Every innovation and subsequent development is based with uniformity in mind. Modern glasshouses are tall, built to a square footprint with no internal glass walls in order to create as far as possible a uniform climate for plant growth. Heating systems are designed to deliver heat uniformly and irrigation systems to delivery water uniformly. Growers left the soil over 40 years ago to work with Grodan stone wool because of improvements in uniformity and more recently moved from laying substrate on the ground to hanging gutters. Uniformity in propagation is equally important because with the right plant specification a uniform batch of plants can be steered from the start of the cultivation for maximum production and quality, where all subsequent inputs - labour, climate and irrigation - can be optimised. In this article the key processes for ensuring uniform saturation of plugs and blocks in order to increase the uniformity of usable transplants will be discussed.

Seed quality and substrate design
Seed quality is naturally the starting point for uniformity in propagation. Delivered in small packages the seeds must be ready for germination when triggered by temperature and water. Breeders and seed companies are investing heavily in technologies to improve seed quality for the greenhouse industry. Companies such as Incotech based in the Netherlands provide a
comprehensive range of treatments to enhance the overall quality of a seed lot. These include fluid density grading and x-ray imaging as well as seed priming and pelleting to improve speed and uniformity of emergence and, most importantly, for a propagator and grower, the number of usable transplants.

Quality, in terms of uniformity and number usable transplants is further optimised by substrate design and use. From a physiological point of view it must be remembered that germination occurs when enzymes and proteins are first mobilised within the seeds, long before the emergence of roots and shoots. This physiological process requires oxygen so the seeding plug must have the correct air : water ratio. This aspect was fundamental in the design of the Grodan Pro plug. Using new Vision Technology this revolutionary new stone wool facilitates better germination rates. Most importantly due to its new configuration and water characteristics, it results in stronger root development and greater plant uniformity, which for the propagator means more usable transplants per sowing (Fig. 1) and for rootstocks an increased percentage of A&B grades at first selection (Fig. 2).

**Maximising potential of Grodan stone wool in propagation**

Prior to sowing, the seeding plugs are saturated for the first time. An EC of 1.2 to 1.5 mS/cm² and the pH = 5.8 is standard, however if the pH of the primary water supply is too low fresh water can be used. In these situations the plugs should be flushed again with fertilised water 3 to 4 days after emergence.

It is important that the initial saturation of the plugs is performed correctly so that all seeds are surrounded by a uniform WC and EC. However, the water should not be applied in one go. A wetting line containing three or four irrigation beams spaced 30 cm apart is the most efficient method to use (Picture 1). It is important that a sufficient volume of water is applied so the belt speed and pressure should not be set too high. The applied water will then have opportunity to move downwards along the stone wool fibres ensuring complete saturation (Picture 2). An open belt that allows the water to drain away quickly further enhances this dynamic flow, preventing air from becoming trapped inside the plug (Picture 3). Weighing individual trays is a simple way to check if the plug trays have been correctly saturated. Trays with 240 cells should weigh between 2.20 and 2.40 Kg.

Sowing is normally undertaken using a vacuum drum seeder and subsequently the seeds should fall into the seed holes, therefore, the holes should be centred in the plug and free from loose stone wool. Seeds are expensive and should not miss their intended target (Picture 4). Following emergence, this will also allow the seeds access to a greater volume of stone wool resulting in more uniform growth. After sowing, the seeds should be covered with and even layer of vermiculite, and it is important to choose the correct fraction. Grade 3 will keep the seeds sufficiently moist but will also allow access to ample light and oxygen, which are essential for germination of tomato.

**Selecting rootstock transplants**

To further enhance uniformity of the graft union, young rootstock transplants are first selected approximately 9 to 11 days after sowing, usually into four or five grades (Fig. 2). This can be done manually or more conventionally by a machine
Selection of plants with a machine increases efficiency for the propagator, but requires a stone wool plug that retains its shape well as each tray may be selected two or three times. The young transplant should also be firmly anchored into the stone wool so that it does not fall over and become damaged during the selection process.

Transplanting into blocks
For single-headed grafted plants transplanting into blocks normally occurs approximately 8 days after grafting. The blocks should be initially saturated in a similar manner as the plugs. Preferably this should also be performed using a wetting line consisting of three or four irrigation beams spaced 50 cm apart. The speed of the belt is important and it should take approximately 40 seconds for the blocks to travel from one irrigation beam to the next. This will give the blocks adequate time to drain. A good visual check is to see the water rise and fall in the plant holes as the blocks pass between the beams (Picture 7). Of course there are other ways in which the blocks can be saturated but the underlying message is that it is a process, which for the best results should be repeated several times. To be sure the blocks have been correctly saturated they can be periodically weighed. Ideally, a 10 cm x 10 cm x 6.5 cm block must weigh 550 g, and a 10 x 15 x 6.5 cm 825 g as it leaves the wetting line. A deviation of +/-25 g is acceptable, a greater deviation will often result in noticeable differences in growth.

As the best transplants have been selected for placing in the blocks they will be stronger. Generative growth can be stimulated by initially saturating the blocks with a higher EC in the range 2.5 to 3.0 mS/cm² and pH 5.6 to 5.8. Once rooted into the block, generative steering towards and plant specification can begin.

Summary
Seed companies and seed technologists are constantly improving seed quality. Their efforts are targeted at increasing the speed and uniformity of emergence. Aligned with these developments Grodan are developing substrates and knowledge targeted at increasing the uniformity of useable transplants. Uniformity can be improved within a seed lot if initial wetting of plugs and blocks is optimised. This ensures optimum WC and EC around the developing seedlings and transplants. In the next article I shall go into more detail on the tools you can use to steer these young plants in propagation, working towards a specific customer wish. Increasingly, this customer wish is for more generative young plants. This is due to the increasing cost of energy, which has prompted changes in climate management at the start of the crop in winter.

About the author
Hans van Herk is a specialist young plant advisor for Grodan, the world’s leading substrate supplier to the professional horticultural industry.