**REPORT OF A VISIT TO THE MUSHROOM DAYS EXHIBITION, DEN BOSCH, AND TO MUSHROOM SUBSTRATE AND PLANT GROWING MEDIA PRODUCERS IN THE NETHERLANDS, 2 and 3 JUNE 2016**

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**Summary**

The Mushroom Days exhibition, which is held every two or three years, was the 34th and had over 80 exhibitors. Whereas previous exhibitions were dominated by Dutch companies, there were exhibits from several other European countries, USA and China. The Dutch mushroom industry, in line with other European countries, has changed dramatically in the previous 30 years. Whereas previously there were over 850 growers producing mushrooms for the fresh market, now there are only 60 although the total production remains similar.

 The main new developments exhibited were new substrates for spawn based on sorghum and grain-free ingredients, compost supplements (MycroFeeder and GranumChamp), drip irrigation (Netafim), a wide range of disinfectant products, and a picking aid for mushrooms (Mobichamp).

 Visits were made to two Dutch grower media producers (Jiffy/Tref and Legro/Topterra) to discuss the current situation with regard to peat substitution in growing media and mushroom casing, and the potential for recycling spent mushroom compost casing in growing media.

**Mushroom Days Exhibition, Brabanthallen, Den Bosch (2 June)**

Mushroom Casing

Exhibitors included the traditional sources of casing (Ireland; Harte and McDon), Netherlands (BVB, CNC, Topterra), and Belgium (Sterckx) as well as a newer supplier into the casing market using peat from Baltic States (Floragard/Florabalt, Germany). All of these casing manufacturers base their casing on wet dug peat with sugar beet lime although they also include various proportions of frozen black peat, milled peat, peat fibres or ground limestone in some of their blends. Topterra also use stone grindings as an ingredient. Casing production in Netherlands and Belgium currently depends on peat mainly from Germany. The supply of peat in Germany is becoming scarcer because current bogs are becoming depleted and the German government is not granting new licences for peat extraction. There is no commercial move towards peat reduced casings in any of the manufacturers although they are trying to substitute wet peat with milled peat and sugar beet lime with other lime sources, and some are conducting research into peat substitutes.

The casing market has changed significantly in the last five years with most casing now being delivered to mushroom farms in bulk. However, all of the casing suppliers at the exhibition still supply casing in 1 to 4.5 m3 bulk bags (size range depends on casing producer) or in 50 litre bags, particularly for customers that are outside of Europe.

Recent disease problems associated with casing materials mean that several companies are conducting a bioassay on casing samples for the occurrence of fungal and bacterial pathogens. Several Dutch casing producers and Wageningen University are examining the effect of casing materials on the occurrence of diseases such as wet bubble and blotch. The aim is to develop a casing material that gives greater resistance to disease although no results have yet been published. A DNA-based test for Mycogone in casing has been developed by BVB and Wageningen University. BVB is developing a casing and compost moisture sensor in collaboration with Vullings, Horst, Netherlands.

Mushroom Compost

Suppliers of Phase II (pasteurised) and Phase III (spawn-run) compost for Agaricus mushrooms at the exhibition included Coenegrachts, CNC, Hooymans, Sterckx, Walkro (Netherlands and Belgium), Pilzhof/Walkro (Germany) and Holpol-Compost (Poland). All of these compost manufacturers produced their fresh (Phase I) compost in indoor tunnel facilities. The majority of compost from these suppliers is now sold as spawn-run (Phase III) compost supplied in bulk; however, they also supply Phase III compost in compressed blocks and fresh (Phase I) and pasteurised (Phase II) compost. Holpol and Pilzhof also supply trays ready for cropping (Phase IV). The metal trays each contain around 260 kg of Phase IIII substrate. After use, the trays are returned by the grower to the composter for steaming and reuse. Unlike mushroom compost production in Britain and Ireland, which is based mainly on wheat straw and chicken manure, the Dutch and Belgian composters used predominantly horse manure from riding stables. Hooymans and Holpol also produce an organic compost based on organic wheat straw (mainly from Germany).

Compost Supplements

Suppliers of supplements for Agaricus compost and exotics substrates at the exhibition were: Champfood, McSubstradd (Netherlands) Amycel, Lambert (USA/France), Lucky Grower (Poland), Nutrigain (UK) and Sylvan (SuperChamp produced by van Korlaar, Netherlands). The majority of products on display were traditional soybean meal based products. As well as traditional protein-based supplements, Amycel now produces Proco, a protein-based supplement containing trace elements. GranumChamp supplied by Lucky Grower is a corn-based supplement. NutriGain demonstrated a new product applied to the casing/compost interface: MycroFeeder. It can be sprayed on to the compost surface on the head end filling machine.

Mushroom spawn and strains

Suppliers of Agaricus strains present were: Amycel, Euromycel (France), Hollander Spawn, Italspawn, Lambert Spawn Europe, and Sylvan. Lambert displayed Speed Spawn, a synthetic grain-free spawn substrate that is claimed to give faster spawn run and reduced green mould infection compared with grain spawn. Sylvan had a demonstration of a new spawn substrate based on sorghum grains (Mylo). The new substrate is claimed to combine the benefits of millet and rye in more cultivation points (like millet) and more nutrients (like rye), resulting in a stronger and faster spawn-run. It is currently available with Sylvan strain A15 but will be available with other strains later. Amycel also displayed a new spawn substrate (Onyxx). The partially synthetic substrate is not grain-free but is claimed to give a faster spawn run with a reduced risk of green mould compared with traditional spawn substrates. Onyxx is available with all of Amycel’s main strains.

Exotics Substrate and Cultivation

Substrates and spawn for exotic mushroom production were displayed by Amycel, BioMycoTec (Germany), CNC Exotic Mushrooms (Netherlands), Eurosubstrat (France),Hollander Spawn, Holpol (Poland) Lambert, Mycelia (Belgium), and Sylvan.

Mycelia produces spawn for over 120 strains of exotic mushroom species. Unicorn Bags (USA) displayed a range of autoclavable bags for exotic spawn and substrate production. SacO2 also displayed autoclavable polypropylene bags (Microsacs) for exotic mushroom spawn and substrates, and polyethylene Microsacs for Pleurotus substrate production. Sylvan displayed a new Pleurotus spawn carrier (HK35 Sonic). The ingredients of the new carrier were not disclosed but the product is claimed to give a faster spawn run than the traditional HK35 millet spawn. BioMycoTec have developed an exotic mushroom substrate based on coffee ground waste.

Amycel produced two supplements aimed at the exotics market: ProMycel Pleurotus and PromMycel Take 33-67.

Pest and Disease Control

The only products for disease control available at the exhibition were Sporgon (a.i. prochloraz; BASF supplied through Sylvan) although this may be withdrawn at the end of 2017, and Banko (a.i. chlorothalonil, supplied through Amycel) which is not registered for use on mushrooms in the UK. Several disinfectant products were available including Kickstart and Fungoclean from Mertens (Netherlands), Agroxide II and Agrigerm 1510 supplied by Amycel.

Nematode based products for control of mushroom flies were exhibited by e-nema (nemacel), Sylvan (BASF Nemasys) and Mertens (Koppert, Scia-rid).

Irrigation Equipment

Netafim had a demonstration of a drip irrigation system for mushroom shelves. The crop is irrigated through 8 drip lines with drippers spaced at 15 cm intervals. There is also equipment for installing, removing, cleaning and storing the drip lines. The main benefits compared with conventional sprinkler or sprayed irrigation are claimed to be: watering can be done at any time without wetting mushrooms, improved yields and quality, less bacterial blotch, reducing the depth of casing material needed, and the potential for adding liquid supplements through the drip lines. There are three demonstration farms of the system in Israel, the Netherlands and Germany.

Vullings demonstrated a fully automated spray irrigation system for shelves. The system is currently controlled on a timer through a computer but the aim is to produce a sensor controlled system. FTNON Dofra supply both pipe and lorry irrigation systems. The pipe system is fixed to shelves and has a lower cost. The lorry system consists of a spray unit which moves along the beds. It is more expensive but produces a more uniform water distribution than the pipe system. The Fancom Lumina 767 and Limbraco VEC41 are computer-based irrigation controllers which also use a timer-based program. Other automated irrigation systems were exhibited by AEM, GTL-Europe Engineering, JF McKenna, Lucky Grower, and Zhejiang Hongye Equipment Technology.

Harvesting Equipment

Van der Top and Christiaens had produced mobile packaging rigs – pickers place untrimmed mushrooms into the rig which then trims, grades and packages the mushrooms. The systems are single layer rigs, which either move over the mushrooms shelves or have the mushroom shelves fed through them.

Mobichamp had developed a picking aid whereby an image system identifies mushrooms ready for harvest and lights them up with a green or red spotlight. The system is claimed to increase picked yield by 10-30% through improved picker performance. The system has the potential to be used as a robotic harvesting system. Currently it can only operate on a single layer growing system.

Mushroom Machinery

The exhibition had several exhibits of machinery used for the production of compost, mushroom cultivation and subsequent packaging and storage. These were mainly based on the indoor composting system and shelf production system. These items were similar to those displayed in previous Mushroom Days exhibitions and are not described in detail here. Whereas previously these produced were almost exclusively made by Dutch manufacturers such as Christiaens, Hoving, Limbraco, and MushComb there were a number of manufacturers from other countries such as Italy (Alpi), Poland (Euro Industry, Lucky Grower), Ukraine (Tera-Chenigv) and Zhejiang Kingfit Environment (China).

**Jiffy Products International, Moerdijk (2 June)**

Meeting with Mr Cees van der Burg, Product Development Manager and
Mr Bram van der Maas, Horticultural Scientist Product Development

Jiffy/Tref produces horticultural substrates in the Netherlands, Sweden, Estonia and the USA. In the Netherlands, 700-800,000 m3 substrate are produced annually. Around 8000 different propagation and substrate products are produced. Jiffy/Tref supply into the UK market through Fargro. Products are certified under the RHP scheme.

The main components for the substrates are black and white peat, coconut fibre and pith (coir), oil palm biomass, woodfibre and perlite. Coconut products are obtained from Jiffy owned coconut plantations in Sri Lanka. Green waste compost is not used for professional products because the salt content is quite high. A maximum of 10% by volume of green waste compost is used for amateur gardening products.

Spent mushroom compost is not currently used in growing media. The main problems are the lack of stability, high respiration, bulk density greater than peat (which increases transport costs) and tendency to immobilise nitrogen.

Organic substrates are produced with biofertilisers such as Tref-ECO11PL. This has avoided the sciarid fly problem associated with using animal sources of nitrogen for organic products. Biocontrol agents such as Trichoderma and Metarhizium are added into some of the blends.

**Legro, Helmond (3 June)**

Meeting with Mr Ted Buis, Sales Director.

Legro produces growing media products in the Netherlands, Germany, India, Australia, China and Mexico. Topterra casing produced in the Netherlands is part of the same group. The main products are substrates for the soft fruit, nursery stock, tree production, and landscaping (including roof gardens) industries. Growing media are produced to the RHP certification. Legro supplies 60% of growing media used in the UK soft fruit industry. Around 30 ingredients are used to produce the range of growing media products. The main components of the substrates are coir, peat and perlite. Peat is obtained mainly from Sweden, Baltic States, Russia and Ireland. Pine bark is only used as a pot topping material. No woodfibre, green waste compost or spent mushroom compost are used. There are no waste materials from the growing medium production. Over-sized peat grades are used in landscaping products.

 Coir is shredded, pre-wetted in bays before mixing and put into cone piles before use. Legro have a blending facility which can combine up 12 ingredients in to a growing medium mix. Fertiliser and biocontrol products can also be added. Biocontrol products include biofertilisers (Orgaplus, Orgapower), disease control (Trianum, Koppert) and Bio1020 (Bayer) for pest control. The latter product (Metarhizium) is used in place of Met 52 which is not approved for use in the Netherlands. Growing media are filled into grow bags which can be 40 -80 cm in length. Legro has a laboratory for conducting chemical and physical property analyses on samples of growing media.

 There is currently no peat substitution in mushroom casing although Topterra has conducted research in this area with Wageningen University. Results with recycled casing were not very promising because the material was not cooked out (and therefore required heat treatment) and the presence of mushroom chogs (which required composting for several weeks).