



FROM THE EDITOR

I have found the last few months to have been a time of reflection for me. Amongst other factors, certain milestones have contributed to this. I have celebrated the infamous 40th birthday, seen the completion of a decade of employment at Highveld Mushrooms and am about to enter the second half of my 20th year in the mushroom industry. In my resulting melancholic mood I found myself scanning through the archives of the early issues of the Spawn Run.

Call me old fashioned, but there is still something nostalgic about paging through an original hard copy and even more so when I came across an article announcing the construction of the new Sylvan Spawn plant, where I started working a few weeks after.

Needless to say I decided I would try and share some of my reminiscing and publish something of yesteryear in this month's issue.

While this piece comes out of the March 2001 issue and deals with the, then, new era of bunker composting, Ray Samp delves into the fundamentals which need to be applied no matter what method or system you are employing. It certainly served as an important reminder for me to not forget the basics; I hope it does the same for you.

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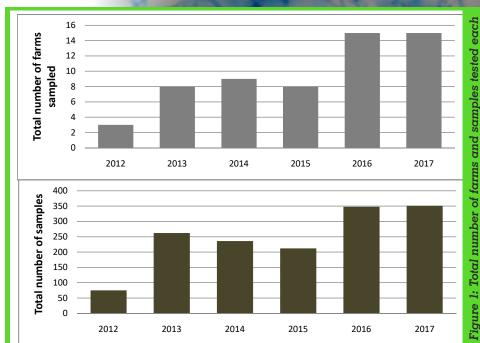
South African Mushroom Disease Outbreak Prevention Services (MushDrOPS)

Siyoum, N and Korsten, L University of Pretoria, Department of Plant and Soil Sciences; Department of Science & Technology/National Research, Centre of Excellence Food Security, Pretoria, South Africa.

The University of Pretoria (UP), Department of Plant and Soil Sciences, Plant Pathology division has been involved in mushroom research since 2003 receiving funding from

the South African Mushroom Growers Association (SAMFA) and originally from the Technology and Human Resources for Industry Programme (THRIP) (2003-2010). The current focus of the UP research programme is on detection of mushroom fungal pathogens in mushroom growing environments, casing material and mushroom compost. A series of modern detection methods has been developed, optimised and implemented to assist rapid detection and diagnosis of the pathogens. This resulted in the development of the Mushroom Disease Outbreak Prevention Services (Mush-DrOPS) programme where farms of all SAMFA member farms are sampled once a year to monitor pathogen spread and provide advisory services in terms of control measures. The current report summarises the tests and results over the past six years and

highlights the potential impact of the survey and services on disease control.



tools and growing rooms. Currently, the presence of the four major fungal mushroom pathogens, *Trichoderma aggressivum*, *Lecanicillium* spp., *Mycogone* spp. and *Cladobotryum* spp. are specifically tested for using both the viable culture and new molecular techniques (Figure 2).

Brief history and results

The "Mushroom Health Checks" disease detection service (as it was originally called) for members of the South Af-

rican Mushroom Farmers Association (SAMFA) started in 2012. In the beginning only three farms could be monitored per year. Later on, the service expanded to include nine farms during the annual assessment. In addition, the Mushroom Health Checks system improved in terms of number of sites sampled, number of samples collected, farms visited (Figure 1), protocol and test methods used and the number of pathogens tested for (Figure 2). Since 2016, each SAMFA member received the service annually. In 2017, the name was changed to "Mushroom Disease Outbreak Prevention Service (MushDrOPS)" to include an advisory aspect. The MushDrOPS comprises monitoring compost production and casing preparation areas, machinery,

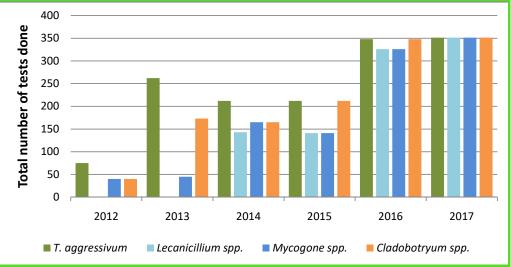


Figure 2. Total number of diagnostic tests done for each of the four major fungal pathogens, *Trichoderma aggressivum*, *Lecanicillium* spp., *Mycogone* spp. and *Cladobotryum* spp. during each cycle, 2012 to 2017.

(2012-2017)

DrOPS programs





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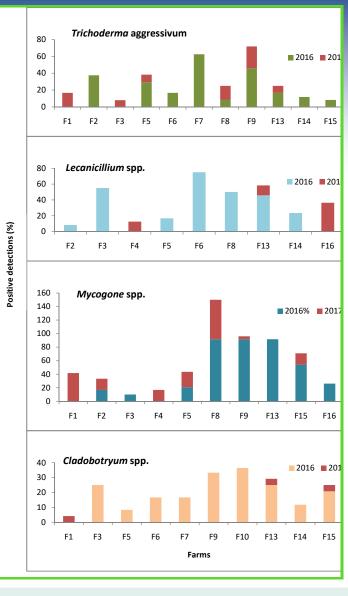
Significance of MushDrOPS

The mushroom pathogens tested for in this study can result in serious crop losses during production of white button mushrooms (Agaricus bisporus (Lang) Imbach) if proper disease management strategies are not implemented. As part of such a strategy, MushDrOPS provides an early disease monitoring system in order to prevent build up of inoculum that could later cause disease outbreaks. The results from MushDrOPS provide a pathogen foot print, showing contaminated areas that need particular attention during scheduled cleaning, disinfection and sanitisation.

The tests and results for the consecutive cycles 2016 and 2017 is summarised in Figure 3 and 4. Pathogen detections were generally lower in 2017 compared to 2016. The number of farms with positive detections also decreased in 2017 from nine to six for T. aggressivum, seven to three for Lecanicillium spp., eight to seven for Mycogone spp. and nine to three for Cladobotryum spp. (Figure 3). The substantial decrease in the number of pathogen detections in terms of total samples and farms analysed clearly reflect the disease control impact of MushDrOPS to prevent inoculum build up and pathogen spread in the respective farms. On a few farms, the pathogens were detected in 2017 only. For instance, on farms 1 and 3, T. aggressivum was not detected in 2016, but only in 2017. A similar trend was observed for Lecanicillium spp. on farms 4 and 16 for Mycogone spp. on farms 1 and 4, and Cladobotryum spp. on farm 1 (Figure 3).

Overall, Mycogone spp. was most often detected and was considered a persistent pathogen on the farms. On the other hand, Cladobotryum spp. was the least detected pathogen compared to the other three (Figure 4).

pathogens, Trichoderma aggres-Lecanicillium spp., Mycogone spp. and Cladobotryum spp. in the mushroom farms [Farm the four major fungal number of detections of 15 through Farm Total က Figure sivum,





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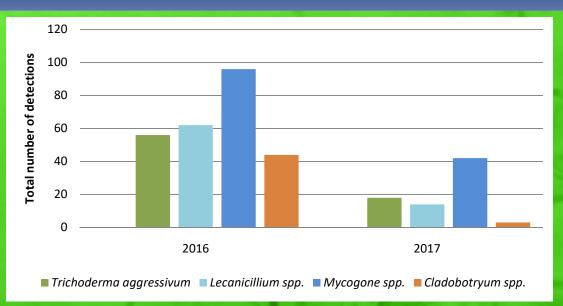
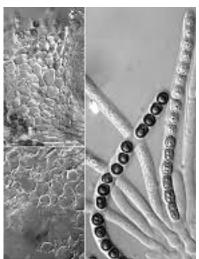
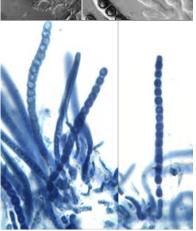


Figure 4. Comparison of overall detections of the four major fungal pathogens, Trichoderma aggressivum, Lecanicillium spp., Mycogone spp. and Cladobotryum spp. during 2016 and 2017 MushDrOPS cycles.

In conclusion, it is very important for the mushroom farmers to follow a preventative approach and monitor disease in their production systems and environment, in order to prevent inoculum build up. The Mush-Health Check/Mush-DrOPS is essential to assess the status of pathogens on the farms. If recommendations are strictly followed, this service can have a significant impact in minimising inoculum build up and to provide an effective preventative disease control strategy.







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Important Dates on the Mushroom Calendar

South African
Mushroom Farmers' Association
(SAMFA) Conference
the October 2018,
Premier Hotel, ORTambo Airport, Johannesburg
www.samfa.carlamani.co.za

Growers Association Conference
11th - 13th October 2018,
Intercontinental, Sydney
www.amgaconference.mushrooms.net.au

The 4th International Conference on Mushroom Biology and Mushroom Products

(ICMB/AP9)

12th - 15th November 2018,

Shanghai, China

www.sh-mushroom.com
/www.worldmushroomsociety.com

2019

25th North American Conference (NAMC) 14th - 16th February 2019 Hyatt Regency, Orlando, Horida www.mushroomconference.org Short Courses by Delphy Mushrooms,
Horst, The Netherlands

Button Mushroom Growing (Agaricus): 8th - 12th October 2018

Edible Mushroom Growing (Shiitale, Ouster, King

Ouster, Namelo, Maitale): 23rd - 26th October 2018

Sal Composting, tunnel management (Agaricus): 14th - 23rd November 2018

mushroooms@delphy.nl

www.delphy.nl

Master Class Mushroom Composting and Growing
22nd - 27th October 2018,
18th - 23rd February 2019
Mushroom Office, Horst, The Netherlands
www.mushroomoffice.com

To ensure that your event is included in The Spawn Run's Mushroom Calendar, please email all the pertinent details to nathan@highveldmushrooms.co.za

Dutch Mushroom Days 22nd - 24th May 2019 The Brabanthallen, Den Bosch, The Netherlands

Brave New Worlds of South Bunker Composting

by Ray Samp, Agari Culture Mushroom Consulting Services

[Reproduced from the March 2001 issue of The Spawn Run]

I have been operating as an independent Agaricus mushroom production consultant for almost 10 years, over which time I have had the opportunity to work in many countries on 4 continents. One of the benefits of this type of exposure is be able to observe different cultural practices used in these places and to be party to technological advances as they develop. One of these technological advancements has been the development of in-vessel bulk phase I composting systems. I have been working actively with about 15 of these systems over the last 5+ years in Europe and the south Pacific and have been in a position to observe the development and evolution of the system. Although bulk phase I composting is not a panacea and there certainly is a learning curve to operating the system successfully, I consider bulk phase I to be proven technology. There may be farm specific modifications that are required from what may be considered "standard procedures", but the ability to produce productive Agaricus mushroom compost from the system has been proven. Because of these beliefs and the exposures I have received, I wish to share my observations, experiences, and opinions on what I believe to be the most important development in *Agaricus* mushroom culture in 15-20 years, that is in-vessel bulk phase I composting.

BACKGROUND

Fundamentally, what are we trying to accomplish in composting? In the simplest terms it is the blending and conversion of high carbon and high nitrogen raw materials in order to produce a selective growth medium that will produce economically viable quantities of Agaricus mushrooms. The major components of straw (carbon) and poultry or seed meals (nitrogen), are mixed with a sufficient amount of water and in the presence of oxygen, develop a microflora, which generates heat. This heat gradually increases until the temperature reaches a point (70+ degrees Celsius, 160+ F) where a chemical reaction takes place, which converts the raw materials. It is important to note that the major components of the composting process, carbon, nitrogen, water, and oxygen, are equal in



importance.

Having laid a basic groundwork of what defines mushroom composting, there are 2 significant systems used to accomplish the process:

- 1. The conventional Sinden short method of composting in ricks.
- 2. In-vessel bulk phase I composting in bunkers or phase I tunnels.

Both systems accomplish the same goals of conversion of raw materials for mushroom production. The difference is a matter of procedure, equipment, and efficiency. I'll explore the differences of the systems later.

Since the principles of the two systems are the same, I break the process of composting into 4 components so that comparative differences can be noted. They are:

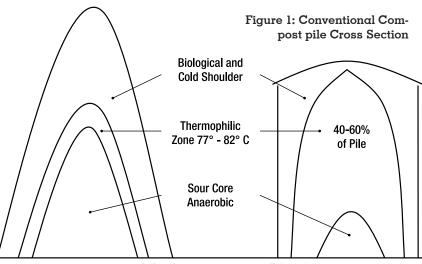
- 1. Prewet The initial wetting and blending of raw materials
- Phase 0 Microflora build-up and biological heat generation. A raw material softening and water absorption period.
- 3. Phase I The chemical phase of composting that occurs at temperatures >160 degrees in the presence in sufficient amounts of the basic compost components.
- 4. Reinoculation Repopulation of the finished phase I compost with the microflora necessary for phase II

I will breakdown the differences of the 2 composting systems into each of these 4 compost cycle components.

COMPOSTING SYSTEMS

In general, conventional Sinden method composting (as interpreted by many American farms) consists of a prewet of dry stockpile and occasional mixing. The time "prewet" and without nitrogen application may last a few days to weeks. After this dry or moist period, the stable bedding or straw is wet by sprinklers or by dipping the materials into a pit. Poultry manure is usually added with a loader bucket and the materials are then mixed using a prewet machine or loaders. It is at that point that phase 0 starts. The compost is piled into large bulk, pyramid, or "A" piles

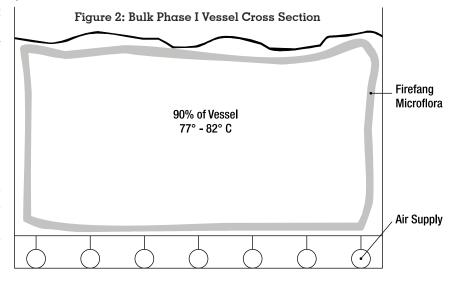
and are moved every day or alternate days to mix ingredients and control the sour core that may occupy \sim 33-75% of the pile. At lower amounts of sour core the piles are generally drier and therefore are less homogenous. The duration of the phase 0 period may be 7 up to 20 days. Finally, phase I is managed in ricks that balance rick size, ingredient addition, and moisture to achieve a high percentage of the pile in a high temperature (70°+C), chemical breakdown situation. The time in ricks ranges 6 to 12 days. When one considers the amount of surface, firefang, and core, conventional piles may achieve $\sim 50\%$ of its mass in this high temperature range (Figure 1). Consequently, to get all of the material in the chemical breakdown range, piles are turned on alternate days in an attempt to switch the material that is outside of the desired range into the center where it has an op-



portunity to reach high temperature. After 4 or more turns it is assumed that the compost is fully converted and is filled directly into phase II since no reinoculation is necessary because plentiful firefang is present throughout the process.

In contrast a bunker process starts with a prewet of soaking straw bales under a boom or sprinklers. Afterwards, optimum+ (excess) moisture is achieved by putting the bales and poultry manure through a blending line where a precise blend of fully wet raw materials is achieved. Using a prewet machine for the blending function is alternatively used. The phase 0 is also achieved by using pyramids, or "A" piles, but for a shorter duration (from hours to 6 days). The sole purpose is to build some microflora and absorb moisture, not to promote decomposition. Finally, phase I is managed in a vessel with an aerated floor. The key to the function of a bunker or tunnel is that the compost is aerated by direct introduction of air through a series of aeration lines buried in the concrete bunker or tunnel floor. The duration of the bulk phase I ranges from as little as 4 days to 16 days, but average is 8-12 days.

The beauty of bunker phase I is that since air is introduced from the floor, nearly 100% of the compost is aerated. Consequently little balancing is required to optimize the percentage of compost that occupies the $70^{\circ}+$ Celsius ($160^{\circ}+F$) temperature range and conversion is much more efficient and rapid. Whereas a decent rick may be 50% $70+^{\circ}$ C, a good bunker may be 90% or more at $70+^{\circ}$ (Figure 2). As such, continuous turning is not necessary and only one, two, and sometimes no turning or "shifting" from



bunker to bunker is necessary. Finally, because bunker phase I is so efficient there may not be enough firefang to sufficiently inoculate the compost for phase II. For this reason a 6-24 hour reinoculation period is often used prior to filling phase II.

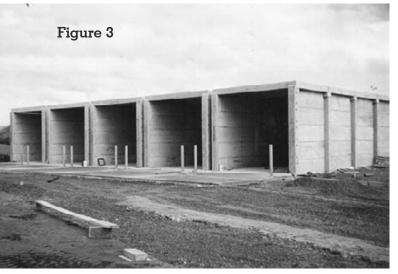
Once again, the composting objectives of phase I in ricks and in bunkers is the same. That is, the complete conversion of raw materials into a compost that will produce a selective growth medium for Agaricus mushroom production. However, it is my experience that the bulk systems can produce the medium more efficiently, in less area, with fewer odors, and with less influence from the ambient environment than the conventional Sinden method. Of course, given the myriad of growing systems present in the world today a finished compost might need other characteristics to dovetail into a particular farm. Issues such as increased moisture absorption and bulk density are particular characteristics that are required by American growing systems. I will review these points later in the appropriate section.

FOCUS ON IN-VESSEL BULK PHASE I

Given the above general characteristics of bulk composting systems, I'd like to concentrate attention to the composition of tunnel or bunker system. I'll use these terms interchangeably to mention general differences. The components of a phase I bunker or tunnel system are:

- 1. The vessel itself
- 2. The air supply system
- 3. The air supply controls
- 4. The scrubber and/or biofilter

The vessel for all intents and purposes is just a concrete slab with aeration lines buried in the concrete floor. There are walls that separate the slab into compartments and there is usually a back wall (Figure 3). Bunkers vary in size, but the ones I work with range from 4 to 10 meters



wide, 30-40 meters long and 4-6 meters high. Buried under the floor are parallel 160 mm aeration lines through which the air is blown, under pressure, to filter upward through the compost maintaining aerobic conditions in the compost at all times. In the case of the tunnel, after the air has percolated through the compost it is exhausted and either recycled through the compost, vented to the atmosphere,

or delivered to a biofilter to remove contaminants. Some bunkers have a roof, usually with the intent to fully enclose at some future date. Once a bunker is totally enclosed and has air recirculation and exhaust biofiltration possibilities, the bunker technically becomes a tunnel.

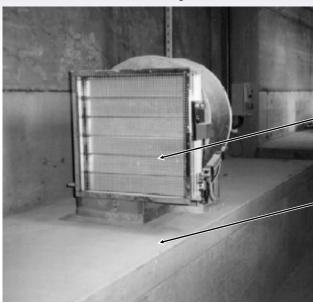


Figure 4:
Air Supply
System

Fan

Plenum

The air supply system starts with a fan that delivers the air to the compost. The air is introduced to the compost in either a high or low-pressure manner. Under high pressure (4,000 Pa and above) the air is delivered in periodic pulses, whereas low pressure (as low as 500 Pa) delivers the air in continuous fashion. The fan blows into a plenum chamber (Figure 4) that feeds the parallel aeration lines



Figure 5: Bunker Filler Inside Bunker

Fan and Plenum

Aeration Lines

that run under the bunker floor. These lines are spaced $\sim\!0.4$ -0.7 meters apart in the floor (Figure 5). From the aeration lines, the air travels up 75-150 mm cone shaped spigots which are placed at ~0.3 -0.5 meter intervals along the lines (Figure 6). The air is finally released to the surface and into the compost through small holes in the apex of the spigots. These holes range from $\sim\!3$ -12 mm in diameter depending on the fan.

I have worked with air supply controls that range from purely manual to sophisticated computer systems. Fundamentally, the system operates to maintain a desired oxygen concentration in the compost so that compost temperature



quickly rises into the 70-80°C range. Over-aeration (too high oxygen concentration) results in slow temperature increase and too much biological decomposition of the straw. Under-aeration can lead to anaerobic pockets of variable size in the compost. Consequently it is important in either a manual or computer controlled system that compost temperatures and oxygen readings are taken on a regular basis. The advantage of a computerized system is that the status of the compost is con-

stantly monitored (even at night) and adjustments can be made automatically based on the measured parameters. Measured parameters might be a number of compost temperatures, 1-2 oxygen samples, and time measurements, all of which can be viewed via various graphics (Figure 7). The temperatures and oxygen samples are gathered by probes, which are placed in the compost. All control sys-



tems (manual or computer) tend to supply more air to the compost early in the process and as temperature increases the frequency or volume of air supply decreases because of the reduced oxygen demand at higher temperatures. Low-pressure systems, which tend to supply a constant flow of air, reduce oxygen concentration in the compost via reduced volume of air, while high-pressure systems push the same volume of air over shorter durations of time. For example, early in the process a high pressure system may deliver air by having the fan on for 20 minutes and off for 10 minutes over a 30 minute time span. Later when high temperatures are achieved that same 30-minute period may be composed of 5 minutes fan on and 25 minutes fan off.

Finally, the scrubber and biofilter system is only used where extremely strict environmental regulations make the production of mushroom compost all but impossible without such systems. The principle is to capture all of the used air as it exits the tunneled compost, recirculate some, but direct the rest of the air through a system that will remove nitrogenous gases, odor causing sulfides, and other gases from the exhaust. Initially the scrubber removes most of the ammonia and other nitrogen gases from the exhaust and then the air is passed through a biofilter that uses a dedicated microflora to convert the remaining contaminants into microbial biomass (Figure 8). These systems are very expensive, and in my opinion, are only partially effective. I feel more work needs to be done to make these systems completely functional and cost effective.



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With all these altered procedures and systems, along with the new technology, one might ask, "why would anyone consider changing a conventional composting system that is known and reliable?" Initially I would say there is really no reason to change unless there are mitigating circumstances. In my opinion, good bunkered compost may only be marginally better than good conventionally made compost, and that slight improvement would only be recognized over time if the new system was managed properly after the initial learning curve. YES, there is a learning curve to be climbed in operating a bulk phase I system. NO, computer controls do not make the medium automatically. The mitigating circumstances that would cause an operation to consider adopting bulk phase I composting can be construed from the following advantages that I have recognized:

- 1. Bunker systems are generally cheaper to build and equip than green field conventional composting sites.
- 2. Much less space and concrete area is required.
- 3. The composting cycle is much shorter due to increased efficiency.
- 4. The short cycle requires less inventory of raw materials (fewer crops in process).
- 5. There is less dry weight loss from start-up to filling phase II.
- 6. The process is much less influenced by ambient weather conditions.
- Odor generation is much reduced due to the shorter cycle, the aerobic nature of the process, and the scrubber/biofilter options.
- 8. Once the process is understood, it is easier to control and manage.
- 9. Labor and energy costs may be reduced.*
- 10. Yield and quality may improve.*
- * These aspects largely depend on the nature of the conventional process used prior to the change to bulk systems.

Of course for every change in technique or technology there are some downsides. The following are some of the disadvantages of bulk phase I systems I have noted:

- 1. Reduced ability to alter bulk density and moisture late in the process.
- 2. Some difficulty increasing bulk density in general.
- 3. The short cycle leaves little margin for error.
- 4. Initial, superior blend of raw materials is critical.
- Most applications are associated with bulk phase II, which handle the sometimes higher activity and lower bulk density better.

Given these advantages and disadvantages of the bulk composting systems I have been asked, "would you recommend conversion to a bulk composting system?" Personally, I have come to the conclusion that if your existing conventional composting process is doing a good job, you have good equipment, and environmental problems are minimal there is little reason to convert. However, if a new or significantly expanded composting site is being contemplated, major investment in conventional equipment is necessary, or if there are significant environmental problems, bulk-composting systems should be seriously entertained.

(...continued in the next issue of The Spawn Run)











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REPORT BACK: Dude Food that's Good Food Campaign

A mix of traditional and digital PR delivers results

by Riana Greenblo from Riana Greenblo Communications

Digital public relations often depend on the story telling playbook of traditional public relations and SAMFA's Dude Food that's Good Food campaign strategically integrated and leveraged both effectively to generate a strong Return on Investment (ROI).

The 2018 campaign differed from the 2017 campaign as it was a media focused campaign without the in-store element that dominated the 2017 campaign.

Target audience:

Remained Millennials and upper LSM males

Campaign message:

Health/Educational to motivate the target audience to include mushrooms on a daily basis.

Campaign creative:

Varied between highlighting the specific male related health benefits of mushrooms, delicious looking mushroom recipe images and a push to enter the competition to win.



Secondary message

This message reinforced the first and was designed to encourage partners to cook with mushrooms. Specific recipes were created for the campaign and these were used in the print advertorials and in the social media campaign.

Communications channels

SAMFA website, social media platforms, on-line banners

and print advertorials pointed participants to SAMFA's website to enter the competition.

Entry mechanism

Participants had to complete a questionnaire that tested their knowledge of the male specific health benefits of mushrooms. **Objective:** to educate about mushrooms in a fun and entertaining way (with a nice reward at the end). Three winners were decided by a random CPA compliant draw.

CAMPAIGN RESULTS

Website Traffic June 2017 vs June 2018

Directing entries through the SAMFA website only increased traffic substantially to achieve set objective.

2017: Total users over period: 1740

2018: Total users over period: 3140

Media Campaign Return On Investment

Excellent editorial coverage and heavily negotiated paid media rates delivered an outstanding ROI:

- Total value of editorial (unpaid) media coverage: R997 273
- 2. Total value of advertorial (paid) media coverage: R1 169 409
- 3. Total coverage value of campaign: R 2 166 682
- 4. ROI: 1:9 (for every R1 spent on the campaign, a return of R9 was generated)

Increasing Samfa Newsletter Subscriber Base

As part of their entry on the website, participants were asked if they would like to receive the SAMFA newsletter.

858 participants were added to the subscription list.

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Size	1100		Benefit
100g white button mushrooms	Protein	3.1g	Replace meat with mushrooms: to lose weight yet still gain muscle.
	Total Fat	0.3 g	
	Saturated Fat	0.1g	
	Calories	22	





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20 Questions with Hannes Sevenster

- Farm Manager, Forest Fresh Mushrooms

How did you get into Mushrooms?

Through a friend, I started as pack shed manager at Country mushrooms..

How many years have you been in Mushrooms? 19 years.

What is most difficult task you have had to undertake while in Mushrooms?

Dealing with the current straw from the drought stricken Western Cape and how this effects growing and production.

What is your greatest strength/talent? Patience.

What is your favourite pastime? Bass fishing.

If you could change one personality/character trait you have, what would it be?

In today's world, being less of a soft-hearted person.

As a student, what did you want to do or be after your schooling?

A pilot.

What was the most significant event in your whole career so far?

Getting up after a big fall in my career.

What do you feel is your greatest achievement in life? I raised a wonderful son.

If budget was unlimited what car would you drive? A Ford Ranger 4x4 bakkie towing a big bass boat

Who has had the greatest influence in your life and why? My Dad, he is such example and inspiration to me and has been throughout my life.

What is the craziest thing you have ever done? I flew up to Gauteng, bought a motorbike and rode it down to Plett with no experience and no licence, stupid

but it was wild.

What are you addicted to? Coke (the black liquid one).

Do you have a nickname and if so what is it and why? No nick name now, but started off at school as Flytrap, heavens know why.

What is your favourite movie? The Shawshank Redemption.

What cheers you up?
My wife and two children.

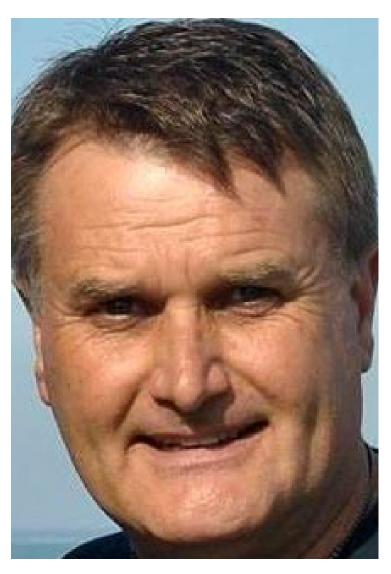
If you could be or were to describe yourself as an animal, what animal would it be and why?

A fish eagle, it is such a gracious animal.

What is your greatest fear? Spiders of any size.

What is your favourite meal? A good Indian curry.

What is the best life advice you have been given? Do everything in such a way that you can stand back and tell everybody "I did that".





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