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FEATURE ARTICLES

ASSOCIATION NEWS

RULES DEVELOPMENT

ACCREDITATION

EDITORIAL

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Dear colleagues, seed testing analysts, and readers,

"The times they are a-changin"; in this April issue of Seed Testing International (STI) we will be addressing some of the changes and novelties in our ISTA world, alongside the regular informational features.

One of the big changes that the Association went through this January was the introduction of the electronic ISTA Rules. This was no small undertaking, and it took more than a year of work on the part of Jonathan Taylor, the Publication Specialist at the Secretariat, Steve Jones and Craig McGill, members of the Executive Committee Publications Working Group, to be accomplished. The change has the promise to enable a more efficient updating of the Rules, easier and wider member access and saving on production costs. It is too early yet to judge how these potential benefits measure in reality, but nevertheless, the first three months brought about some simple logistical lessons, and some feedback and experiences that Jonathan will be sharing in this issue (page 32).

Our feature articles are also about novelty. The first work addresses the question of how to evaluate new advanced technologies. The authors propose a statistical approach that they have developed based on the results of ISTA Proficiency Tests of Other Seed Determination. The paper then demonstrates methods for using the data to generate quality standards for a new advanced method (page 4). The two other articles come from the Advanced Technologies Committee; each describes a new potential methodology for estimating seed quality. The first looks into exploring the relationship between chlorophyll content and the state of the seed, thus utilizing chlorophyll fluorescence for seed quality estimates (page 7). The second explores spectral imaging to determine morphological and biochemical parameters associated with seed quality (page 10).

Another novelty is physical, and is something we will experience at the Ordinary General Meeting in Edinburgh this coming June: electronic voting. The red and green cards that have served ISTA for many years, and the exciting ritual of counting ... and recounting ... the raised hands, will be replaced. At this year's Annual Meeting we will be introducing electronic voting. The article on page 23, accompanied with a photograph of the new gadget, will provide some insight into how this new method of voting will be used.

Last but not least, a new Doctor within ISTA's ranks! Jean-Louis Laffont, Chair of the Statistics Committee, has received his Doctorate degree. See more about Dr. Laffont on page 32.

Pleasant reading and I hope to see you all in Edinburgh.

Yours sincerely

Beni Kaufman

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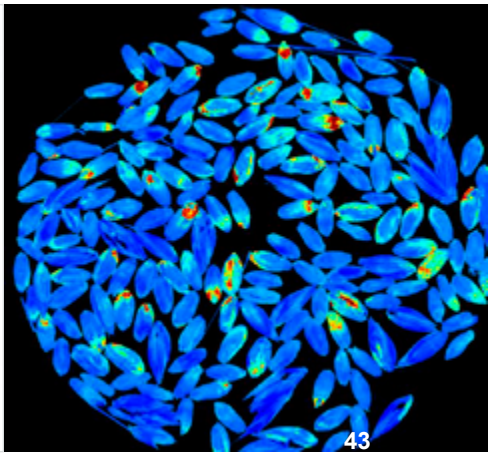
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President's Report

Joël Léchappé

At present, our Association has 205 members from 74 countries or distinct economies, and 127 accredited laboratories. More than 250 scientists, technologists and seed experts, ISTA's technical heart, contribute to its work as members of the 17 Technical Committees (TCOMs) and Working Groups. They were confirmed by the Executive Committee (ECOM) at the 2013 ISTA Congress in Antalya (Turkey) and come from seed testing laboratories, universities and the seed industry. ISTA Members are often members of other international bodies working in the seed sector, such as the OECD, AOSA or ISHI, or of national certification systems or regional associations of seed analysts. This diversity is of great value to ISTA, as it gives a worldwide overview as well as a local view of the needs of the users of the ISTA Rules. The ECOM strongly supports the TCOMs in welcoming new members from different geographical regions and fields of expertise. The voluntary contribution to ISTA is welcome. The work of the TCOMS receives technical and administrative support from the Secretary General and his team in the ISTA Secretariat. Thanks go to our active members, the Secretariat and our network of collaborating organizations.

ISTA's mission, harmonizing seed testing worldwide and contributing to facilitate the seed trade, is achieved by the following:

The **ISTA Rules** are updated every year, and are now available as an electronic version.

The **ISTA Orange International Seed Lot Certificates** (OICs) are used by the trade to import and export seed lots.

In support of the ISTA Rules, every new method must go through a **validation programme**, to check the repeatability and reproducibility between laboratories. This guarantees the accuracy and harmonization of ISTA methods worldwide. Method validation requires close collaboration between the *ad hoc* technical committees, the Rules Committee and the Technical Coordinator, and the voluntary contribution of the ISTA laboratories undertaking the validation studies. The validation reports are available on the ISTA web site.

ISTA also provides both Members and non-members with up-to-date **scientific and technical knowledge** in its journal *Seed Science and Technology*, the ISTA Rules, the handbooks and the news bulletin *Seed Testing International*. TCOMs are also organizing more and more workshops and seminars hosted in member countries, in close coordination with the local hosts and the Secretariat. So far for 2014, 10 workshops have been scheduled, on quality assurance, tree and shrub seeds, sampling, seed health, vigour and image analysis tools, in Indonesia, India, and Eastern and Western Europe.

ISTA Member Laboratories are also provided with a complete programme of **proficiency tests** (PTs) as part of their membership. The PT programme is very helpful, adds value to the laboratories, and allows comparisons between the accredited laboratories. It also allows non-accredited laboratories to benchmark themselves against accredited laboratories. The PT programme is also open to non-members as a paid service.

The **ISTA laboratory accreditation** scheme, established in 1995, helps guarantee the quality of harmonized testing worldwide.

The ECOM is proud to actively contribute to the development of these ISTA services and to make them available worldwide via the TCOMs and the Secretariat.

The ECOM, newly elected in June 2013, held its first official meeting from 8–15 February 2014 in St Petersburg, Russia. Alexander Malko, ECOM member, and his team provided excellent facilities, helping the meeting to be a huge success. The ECOM thanks the Russian Ministry of Agriculture and the Russian colleagues for hosting the meeting. Russia has been an ISTA member since 1965, and has 6 Member Laboratories, 5 of which are accredited. Like other countries, Russia makes the use of OICs compulsory for the import of seed lots into Russia. This regulation acknowledges and supports the role of ISTA accreditation and the ISTA Rules in their seed trade.

Part of the agenda was aimed at completing ISTA's regulatory work, i.e. to finalize and approve the reports and documents to be submitted for voting at the Ordinary General Meeting (OGM), and to coordinate the planned actions with the ISTA strategy. Among the documents approved were the Secretary General's and ECOM reports, the Rules proposals and the related method validation reports provided by the TCOMs and the Rules Committee. In discussions, the ECOM also highlighted the great quality and amount of work again done by the TCOMs and the Secretariat.

The **financial accounts** for 2013 and the provisional budget for 2014 were presented by the Secretary General, and confirmed that ISTA's finances are healthy, allowing the development of new projects to be funded and membership fees to be retained at their current level. The new projects are to continue to financially support the work of the TCOMs, to extend the use of web conferencing to the TCOMs, to design a new web site and to better promote ISTA worldwide. These projects and ongoing topics are detailed below and in the ECOM report. They will also be presented and discussed at the OGM in June.

By now you should have received the agenda and the documents for the OGM.

Since the 2013 Congress, the introduction of **in-house methods** for germination testing has been looked at in depth by a Working Group, chaired by Joost van der Burg (Netherlands) and co-chaired by Masatoshi Sato (Japan) from the ECOM, with members of the ECOM, ISF and Secretariat. Its goal is to prepare a paper to present views both for and against the concept of in-house methods in germination testing. The ECOM, after considering closely the arguments of the Working Group, supports the current ISTA system, and does not see the need for in-house methods for germination testing. Nevertheless, answers are needed to the main questions that led to the discussion of standard methods versus in-house methods. There were an increasing number of requests for validation of new substrates, as well as a request from the seed sector for changes to the germination methods to meet their specific needs, such as usable plant tests. A presentation and discussion on this topic will be organized for the OGM.

For the second year, the Working Group on **Management and Finances** (Chair Steve Jones, Canada), together with the Secretariat, studied the financial data with the accounting system using the ISTA financial tool. The calculations and principles to allocate expenses and resources have been checked and validated. This tool, which still needs to be refined, helps to accurately define the ISTA financial policy. For example, it will be used to gather the final financial data for the Working Group on Accreditation Review by 2016, as announced at the 2012 Ordinary Meeting.

The success and the limits of the **ISTA Rules** depend on four parameters: the scientific and technical content provided by the TCOMs, the method of publishing (including availability), the price, and the language. The ECOM Working Group on **Publications** (Chair Craig McGill, New Zealand) has been working in close collaboration with the Rules Chair (Steve Jones) and the Secretariat on the electronic publication of the ISTA Rules. This goal has been achieved with the electronic publication of the 2014 Rules. This first electronic edition will be improved according to your feedback. Moving to electronic publication brings many advantages, benefitting all categories of users, among which are easy access from the internet, free multi-user access for Member Laboratories, chapters available separately, no amendments but a new complete updated version each year. With regard to the price, to promote a wider use of the Rules, Chapters 1 (Certificates) and 2 (Sampling) can now be downloaded free of charge also by non-members, as was already possible for Chapter 7 Seed Health methods. The pricing policy is still under scrutiny by the ECOM.

Electronic publication also opens new perspectives for development. The Working Group on Publications has discussed how best to facilitate the translation of the Rules into other languages and how to ensure that the translated Rules are widely available to the speakers of these languages.

Furthermore, the need to reduce the times between testing, reporting and delivery of seed lots is becoming a major challenge for the seed trade. The ECOM regards the electronic issue of OICs as a contribution to shortening the delays, and will next work on this issue. Your opinions and suggestions as Member Laboratories issuing OICs, their clients, or stakeholders would really be appreciated, and would help to define the way forward.

The Working Group on **Review of the Accreditation System**, chaired by Rita Zecchinelli (Italy), and comprising representatives from the Designated Authorities of Australia and New Zealand, the ISF and the Accreditation and Technical Department of the Secretariat, has been working on defining the needs of the laboratories and stakeholders. ISTA Members all had the opportunity to complete the accreditation questionnaire sent to Members, accredited laboratories and Designated Authorities. Your contribution was very significant; I take this opportunity to thank you for it. The analysis of the questionnaire will also be presented in June.

In the ISTA strategy adopted in Antalya in 2013 there were several goals concerning the development of services provided by ISTA in more regions of the world. A first-step analysis by the Secretary General shows that there is indeed room for developing ISTA in various regions. The 205 current members come from only 74 countries or distinct economies; compare this to the 196 member countries of the United Nations. Some geographical regions are underrepresented (e.g. Africa and Asia). The hosting of workshops in India and Indonesia in 2014 is therefore welcome. There is also potential for a higher contribution from the seed industry, representing about 30 % of the current Member Laboratories. The ECOM considers the development and promotion of ISTA as a major project, requiring coordinated efforts and appropriate resources. Based on a business case prepared by the Secretary General, a Working Group on the **Promotion of ISTA** (Chair: Berta Killermann, Germany, co-chair: Craig McGill, New Zealand) has been set up. A new position aimed at marketing ISTA has also been created in the Secretariat, and a budget allocated to fulfil this.

I look forward to seeing you at our next Annual Meeting in Edinburgh, UK from 14–19 June. The next Annual Meeting and Congress will be in Uruguay in 2015 and in Estonia in 2016. The workshops, seminars and Annual Meetings are very good opportunities for sharing experiences, and are essential for the development of ISTA. The organization of these events is made possible thanks mainly to the voluntary contributions of people in the hosting countries along with the help of the Secretariat.

Hosting an ISTA meeting in your country is an opportunity to contribute to ISTA, to reduce costs (e.g. for travel) for participants from your geographical region, and to encourage the development of seed testing structures in your region. If your country would like to host an ISTA Annual Meeting in 2017 or 2018, or the Congress in 2019, please contact the Secretary General.

On behalf of ISTA I am pleased to invite you to these meetings and to work together and be part of the evolution of ISTA by sharing experiences with other experts from all over the world.

A high attendance at Annual Meetings is one of the best supports and rewards that the organizers can have.

I personally thank you all for your active contribution to ISTA.

Your President

Joël Léchappé

(prepared with the assistance of Craig McGill, Steve Jones and Rita Zecchinelli)

Quality standards for supporting advanced technologies in Other Seed Determination

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Introduction

The determination of other seeds by number (other seed determination: OSD; ISTA Rules Chapter 4 (ISTA, 2013)) is, amongst others, an important test of seed quality. In routine testing, these labour-intensive determinations are carried out by hand.

Over the past years there have been various initiatives by technical companies to develop computer-aided imaging systems to automate OSD. These efforts are hampered not only by technical obstacles. Very rapidly, the highly relevant question arose how accurate such equipment needed to be in order to be accepted for use in routine seed testing. The standard initial answer to this question is that a single other seed might be relevant for certifying or not certifying a seed lot, and that consequently the machine needs to be 100 % accurate; every seed of another species needs to be found, separated and (if possible) identified.

Since in an OSD there is always a certain number of false negatives, the response of the company is usually that the accuracy cannot reach 100 %. Then, after the importance of such certification decisions has been elucidated, the discussion finally comes to the question how good a seed analyst is, and what the current detection rate is in routine OSD. If the equipment is as good as a seed analyst, or even a little better, it should be acceptable, even if not 100 % accurate.

At this point, seed testing scientists must admit that there is no data set from which standards of accuracy for OSD can be derived. No such data or conclusions have so far been published. Therefore, although we can agree that the detection rate does not need to be 100 %, we do not have an acceptable minimum level.

Such a discussion with a company currently engaged in developing such a system led to the question how a minimum detection rate in OSD might be determined which reflects the current accuracy level of seed analysts, and thus might transparently show what accuracy the system would need to achieve to be acceptable.

In following these questions, the strategy of the current study was to put together a data set with results of proficiency tests and comparative tests, in order to derive values for good seed testing practice in OSD. The aim is not explicitly to establish standard values for ISTA purposes, but to show how, in principle, existing data could and should be used to support advanced technologies by providing clear minimum standards.

Materials and methods

For this evaluation, the results of 27 international and national proficiency tests, with samples from a total of 64 different proficiency test seed lots, and 1656 OSDs were digitalized. Between 15 and 102 laboratories had participated in these proficiency tests, which had taken place between 1996 and 2012. ISTA proficiency tests were not included. The 27 proficiency tests comprised 17 main species from 13 genera. In each test, the samples were spiked with seeds from up to 10 different other species. In total, 21 756 seeds of 161 other species were added to the samples of the 64 proficiency test seed lots, thus forming a total of 269 combinations of main species and other species.

The result of an OSD is comprised of the rates of detection of the seeds of each other species with which the sample was spiked. A total of 7861 such detection rates was calculated at the laboratory level. Other seeds were rated as being correctly detected if at least the genus was reported correctly. Thus, the detection rate included both the detection of the other seeds and their correct identification at the genus level. In this study, these two aspects were not separated. Detection rates greater than 100 % were taken as 100 %. From the results of the OSDs reported by the laboratories, mean detection rates and variances were calculated for each combination of main and other species.

The mean detection rates showed a very wide variation, and confirmed very quickly that detection rates cannot be expected to be constant for any given other species. For example, finding and identifying a wheat seed in a grass seed sample would be easy (resulting a high detection rate), but in a wheat-type triticale sample would be a huge challenge (resulting in a low detection rate). It was thus necessary to consider all 269 combinations of main and other species individually. Therefore, the combinations were graded by two OSD experts, and assigned to one of the three classes 'easy', 'moderate' or 'difficult'. This grading was made without the experts knowing the detection rates calculated from the proficiency test data set.

In order to check for consistency of the grading, the influence of the nominal explanatory variable grade on the continuous response variable detection rate or detection variance was tested in a linear model and generalized linear models with binomial, quasi-binomial and beta-binomial link functions (Lesnoff, 2012).

Quartiles and cumulative distribution functions were determined on the basis of the combination means. For each class a beta-binomial (Yee, 1996) one-way 90 % confidence interval for the lower border of the detection rate was also calculated, based on the number of other seeds that were detected for each combination (Table 1). For the cumulative distribution functions, polynomial regression functions were set up in such a way that the coefficient of determination r^2 was greater than 0.99.

Furthermore, the variance of the detection rate and the one-way 90 % confidence interval for the lower border on the basis of a beta-binomial model were calculated for each combination of species.

All calculations were done using the statistical software R (R, 2013).

Class	Quartiles					Beta binomial derivations		
	0 %	25 %	50 %	75 %	100 %	Mu	Rho	CI min
easy	0.41	0.87	0.94	0.98	1.00	0.91	0.10	0.78
moderate	0.24	0.68	0.83	0.88	1.00	0.76	0.14	0.53
difficult	0.00	0.17	0.41	0.62	0.82	0.36	0.38	0.02

Table 1. Overview of the quartiles of the detection rates per class and 3 values derived by the beta binomial distribution. The 50 % quartile is the median of the mean main species – other species detection rates per class
Mu = mean of the class as estimated on the basis of a beta binomial distribution
Rho = dispersion parameter of the beta binomial distribution (rho is zero if the empirical variance is not bigger than expected; otherwise rho can increase to almost 1).
CI min = beta binomial one-way 90 % confidence interval for the lower border

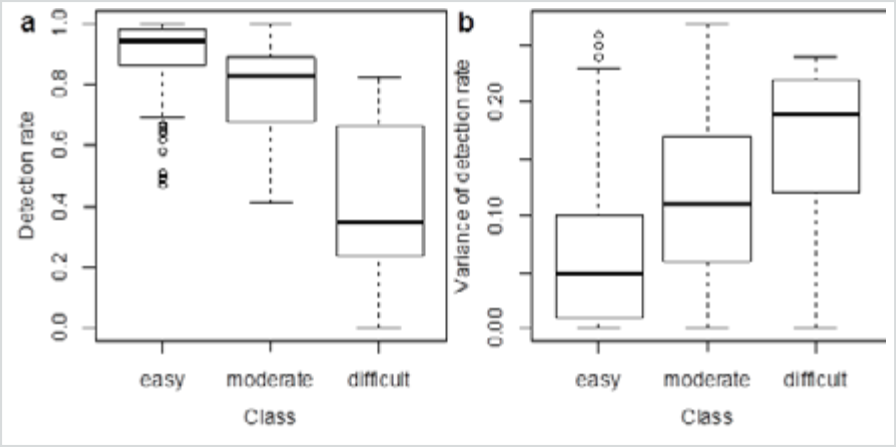

Figure 1. Boxplots of the means (a) of the detection rates of combinations of main and other species and variances (b) grouped according to the classes 'easy', 'moderate' and 'difficult'.

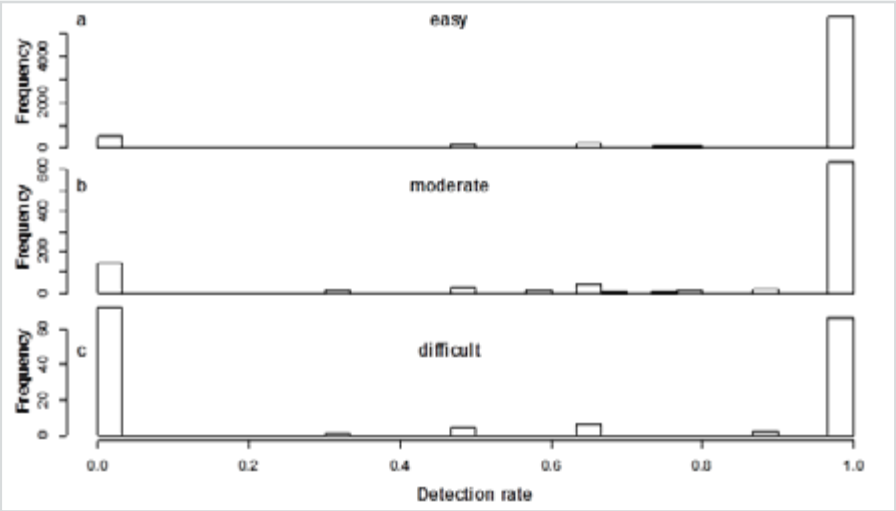

Figure 2. Histograms of the 7861 detection rates at the laboratory level for each of the three classes 'easy', 'moderate' and 'difficult'.

Results

Of the 269 species combinations, 234 were graded as 'easy', 29 as 'moderate' and only 6 as 'difficult' (homozygous fatuoid *Avena sativa* in *Avena sativa, Sinapis arvensis* in *Brassica rapa, Festulolium* in *Festuca trachyphylla, Festuca filiformis* in *Festuca trachyphylla*, two- or six-row *Hordeum vulgare* in *Hordeum vulgare* and *Festuca pratensis* in *Lolium perenne*). Means and variances of the detection rates were calculated for all 269 combinations. The boxplots in Figure 1 give an overview over these mean detection rates and their variances per class.

In Figure 2, the three histograms of the 7861 detection rates grouped according to the three classes (easy: 6765, moderate: 943; difficult: 153) each have two main peaks at 0 % and 100 %. This is caused by the fact that if a sample were spiked with one other seed, this can have been either detected (100 %) or not (0 %). If a sample were spiked with two seeds of one species, possible detection rates would be 0 %, 50 % or 100 % , and so on.

The histograms show that in the class 'easy', laboratories achieved a detection rate of 100 % more often than in the class 'difficult'. In this class, 0 % was reported more frequently. However, the histogram for the class 'easy' also shows that 520 laboratories (approx. 8 %) detected none of the other seeds classified as 'easy', while 5761 laboratories (approx. 85 %) detected all of these. On the other hand, the histogram for the class 'difficult' shows that 67 laboratories (approx. 44 %) detected all other seeds classified as 'difficult', while 73 laboratories (approx. 48 %) detected none of these.

From the data in Figure 1, empirical cumulative distribution functions were established and three polynomial functions were adjusted, one for each class (Fig. 3). These distributions and functions can now be applied as follows: if an imaging system for OSD is at least as good as the better

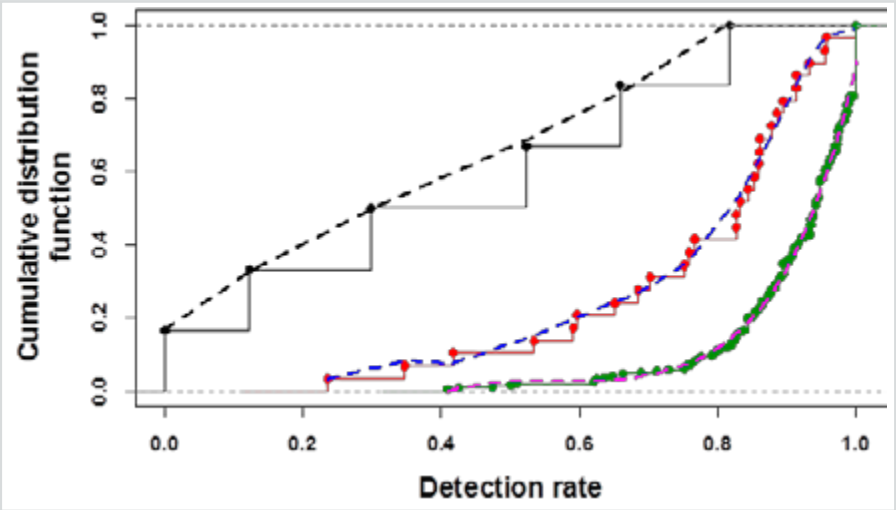

Figure 3. Cumulative distribution functions of the mean detection rates of the combinations of main and other species per class 'easy' (green dots and line), 'moderate' (red dots and line) and 'difficult' (black dots and line). The dashed lines show the polynomial regression functions that were adjusted for the classes
'easy': $y = 54.926x^5 - 171.688x^4 + 219.149x^3 - 141.244x^2 + 45.601x - 5.844$; $r^2 = 0.9911$ (pink dashed line)
'moderate': $y = -359.119x^6 + 1290.042x^5 - 1859.256x^4 + 1373.908x^3 - 546.284x^2 + 110.488x - 8.788$; $r^2 = 0.9912$ (blue dashed line) and
'difficult': $y = 1.2231x^3 - 1.5112x^2 + 1.4427x + 0.1703$; $r^2 = 0.9983$ (black dashed line).

75 % of the seed analysts, then for 'easy' other seeds the detection rate should be at least 98 %, for 'moderate' 88 % and for 'difficult' 62 %. These values are also shown in Table 1. Thus, any minimum detection rate for the three classes can be inferred directly from the empirical cumulative distribution functions in Figure 3, or can be calculated from the three polynomial regression functions adjusted to these cumulative distribution functions.

The polymodal distribution, which also still exists for the class 'difficult', if combination means were calculated from the single detection rate values, is a problem for the linear, binomial and beta-binomial models, and therefore the model fit is suboptimal, as can be seen from the residuals. Nevertheless, model fits were performed for the three classes, the influence of which was always highly significant, and the resulting confidence intervals are given in Table 1.

Discussion and outlook

In all discussions during the past decades with companies developing image analysis systems for OSD, the final question was how accurate the system needs to be to be suitable for seed testing. This is difficult to answer without a sound quantitative basis for the accuracy of the traditional method. Proficiency tests, in particular in OSD, are run every year, but are not evaluated for this kind of evaluation and use of the results.

Therefore, as an example in this study, data of proficiency tests were combined and analysed in order to quantify the average quality of OSDs and their variance. The result is not a quality standard, that by its nature is a valid standard or tolerance. It is still the task of ISTA to define authoritative tolerances regarding the minimum number of other seeds to be found. The result of this work are options: mean and median of the detection rate, other quantiles of the distribution of the detection rates, and all these values for different classes of difficulty. However, this already forms an unprecedented support for companies, since these values and the cumulative distribution function provide orientation for the new advanced technologies, and allow them to demonstrate their comparative performance.

Tolerance tables for the maximum allowed differences are not helpful for defining the minimum number of other seeds. Maximum ranges as listed in Tables 4A, 4B or 5B–E (ISTA, 2013) or ISO standard 5725-2 (ISO 5725-2, 1994) only check whether the difference between the maximum and minimum results exceeds a tolerated range. The developer of an imaging system, on the other hand, might want to be significantly different from the other result (i.e. better), so that exceeding the maximum tolerated range at the upper end of the detection rates might be a preferred result. Hence minimum detection rates are the better choice.

The calculation of confidence intervals for OSDs was hampered by the fact that the sample size from which the single laboratory detection rates result was very low – not many other seeds were added to the main species – and that the detection of other seeds in routine testing is not (only) determined by random distribution, i.e. the sampling error, but by the ambition of the laboratories or analysts. In many of the proficiency tests analysed, the latter showed a very high variation, i.e. a very high overdispersion, represented by the parameter rho. This caused the confidence intervals for single samples to range sometimes down to 0 % or to be not available. Therefore, to avoid this obstacle, the confidence intervals as shown in Table 1 and the empirical cumulative distribution functions, together with their fitted polynomial regression functions in Figure 3, were calculated on the basis of the mean detection rates of the combinations of main and other species for each class. Nevertheless, since there are differences in the detectability of different combinations, even within the same class, the detection rates and confidence intervals can provide an orientation for each combination of main and other species.

The methodology of seed testing is quite traditional. In soil testing, there are new approaches and technologies entering the market every year. What are the reasons for this conservatism of seed testing? Analyses are not measurements but assessments, and are based on personal skills and experience. New advanced technologies are confronted with very high requirements and expectations. Nevertheless, the future of seed testing will also depend significantly on the question how well new technologies can be supported, introduced and accepted by the seed trade, because the challenges of the traditional methods (labour intensive,

requiring trained personal, time consuming) will be tolerated less and less by the markets. Thus, standardizing bodies such as ISTA should develop strategies to help new advanced technologies get access to routine testing, by defining adopted standards not only for technical aspects but also for quality aspects of the methodology. To make use of existing data from proficiency tests is a helpful and efficient approach for this task.

Acknowledgements

Thanks to Mr. Jochen Pfäfflin for his essential contribution in grading the difficulty levels of the combinations of main and other species. Furthermore, we would like to thank the Agricultural Inspection and Research Institution in Hameln, which provided all proficiency test data, and of course all the persons and analysts who organized, conducted and participated in the proficiency tests, without whom this paper would not have been possible.

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Chlorophyll fluorescence as an indicator of seed quality

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It is often difficult for the seed testing community to evaluate the value of new seed testing methods. One of the goals of the ISTA Advanced Technology Committee (ATC) is to identify and evaluate such methods for practical use in seed testing. This may facilitate the development of new methods to become routinely applied and eventually to be incorporated into the ISTA Rules.

'New' technologies may be 'new' because of several reasons: an improvement of an existing method in the ISTA Rules, or a totally new principle for assessing seed quality. A new principle may be in various stages of 'new'; it may be commercial or precommercial.

One of the promising new technologies that has been identified by the ATC is chlorophyll fluorescence (CF).

Chlorophyll is often present in seeds during their early development. A relationship between chlorophyll content and seed quality was discovered as early as 1989 (Steckel *et al.*, 1989). During maturation, the chlorophyll content of a seed generally decreases gradually. Consequently it is related to the maturity of the seed (Steckel *et al.,* 1989*,* Smolikova *et al.,* 2011). The chlorophyll level can be assessed by destructive chemical extraction methods followed by optical detection (Breia *et al.,* 2013, Canakci *et al.*, 2007; Green *et al.,* 1998, Lindgren *et al.*, 2003; Onyilagha *et al.*, 2011), but this is less convenient for routine testing. A new method has been developed, based on the detection of chlorophyll by its fluorescence. This new method can determine the seed chlorophyll content quickly and non-destructively.

The goal of this paper is to evaluate the present status of the method and provide suggestions how to develop it further for routine application in seed testing.

The principle of CF

The present method of CF measurement as an indicator of seed quality was described in 1998 (Jalink *et al.*, 1998a, b) and patented in 2000 (Jalink, 2000). Based on this technology, various companies designed and marketed seed CF meters, such as the Seed-Analyser (Fytagoras and Astec Global) and the iXeed CF analyser (RhinoResearch/Centor Group) and sorter (SeQso/Centor Group). Meters are currently used by a number of seed companies.

The principle of CF is that light of a certain wavelength is emitted by a suitable source (LED, laser) and shone onto a seed. As a result of the absorption of this light, the chlorophyll in the seed emits fluorescent light of a slightly longer wavelength. This emitted fluorescent light is captured by a camera or photo multiplier and thereby transformed into a small current of a few picoampères (pA). The strength of the current is related to the intensity of the fluorescence, and hence to the chlorophyll content of the seed.

The chlorophyll content in seeds is related to maturity in many species, and thus to seed quality parameters. In general, chlorophyll declines with increasing seed maturity and quality. Steckel *et al.* (1989) demonstrated the principle on *Daucus carota*, and Jalink *et al.* (1998a, b) and Dell'Aquila *et al.* (2002) on *Brassica oleracea*. Onyilagah *et al.* (2011) found that *Brassica napus* seeds containing higher levels of chlorophyll are more prone to deteriorate in the presence of adverse environmental conditions. In addition, these seeds had poorer seedling vigour and field performance. Deleuran *et al.* (2013) demonstrated the relationship between CF and mean germination time in *Spinacia oleracea* seeds.

One of the advantages of the new equipment over the older chemical extraction and microscopic methods is speed: it takes less than a minute for a sample to be evaluated. Furthermore, this method is non-destructive, and it is sufficiently precise and sensitive to be used on single-seed measurements.

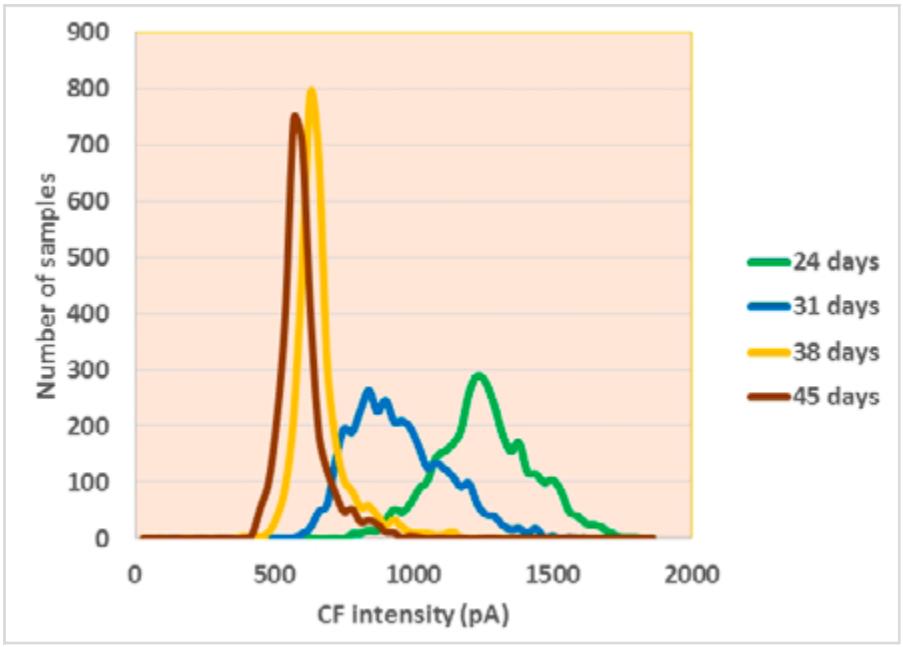

Figure 1. Histograms of CF intensity (in pA) for rice (*Oryza sativa* 'Zhenshan') seeds harvested at 24, 31, 38 and 45 days after mid-anthesis. The earlier harvested seeds show a higher average CF level and a more heterogeneous CF distribution (CF intensity values spread over a wider range). With maturation of the seeds, CF intensity decreases and homogeneity increases (CF intensity distribution becomes smaller). Measurements done with SeedAnalyser equipment, data courtesy of Fiona Hay (International Rice Research Institute, Philippines) and Bert van Duijn (Fytagoras, the Netherlands).

Uses of CF

The CF meter can be used for setting optimal harvest timing by determining the level of seed chlorophyll that indicates desired maturity. This can be particularly important for indeterminate crops that also have the potential to shatter, as it is not possible to wait until all seeds are mature before harvesting.

Upon arrival of the seed lot in the warehouse, CF can help to decide how to clean, upgrade and store the lot.

As the method is very sensitive and the chlorophyll content is related to the germination quality of the seed, CF has been incorporated in a seed sorter to remove immature seeds and improve the germination percentage or storage potential of seed lots.

For some types of seed, the method may also identify cracks in the seed envelope, as uncovering of the inner tissue of the seed due to the crack may affect the CF reading (H. Jalink, pers. comm.). No detailed studies on this possibility are yet available.

In addition, the meter is suitable for research or testing related to seed quality. As CF is primarily related to seed maturity, any seed quality parameter associated with seed maturity, such as vigour or potential longevity, might be correlated with CF values. In addition, the chlorophyll content may change during imbibition, and can be monitored by CF (Jalink *et al.*, 1999), providing a potential opportunity to assess seed quality during priming or in germinating seeds.

The method is now in use by seed companies for in-house assessment of seed quality, determination of harvest time and seed sorting, indicating that this method can complement more conventional seed evaluation and separation methods such as air separation and size and colour sorting. Seed sorting and evaluation machines based on CF are currently being used for *Brassica* spp., pepper (*Capsicum annuum*), tomato (*Solanum lycopersicum*), fennel (*Foeniculum vulgare*), various grasses, tobacco (*Nicotiana tabacum*), rice (*Oryza sativa*), carrot (*Daucus carota*), cotton (*Gossypium* spp.), sunflower (*Helianthus annuus*) and beet (*Beta vulgaris*) (J.W. Hoopman, F. Schreurs and A. Blaakmeer, pers. comm.). Work in barley (*Hordeum vulgare*) by Konstantinova *et al.* (2002), in rice (*Oryza sativa*; Fig. 1) by Van der Burg *et al.* (2009), in soybean (*Glycine max*) by Cicero *et al.* (2009) and in coriander (*Coriandrum sativum*) by Górnik *et al.* (2013) show a relationship between CF and seed quality also in these species. *Allium* (results from both *A. cepa* and *A. porrum*)(J.W. Hoopman and A. Blaakmeer, pers. comm.) and pine (*Pinus palustris*) (Barnett *et al.*, 2006) seem to be crop genera in which CF cannot (or very difficult) be related to seed quality.

Equipment can be of various types, e.g. for analysis of whole seed lot samples or for single seeds. There is also equipment for laboratories, and mobile equipment for checking samples in seed production fields.

Present status of the method and how to proceed

As CF is related to germination quality, it could be registered as a vigour test method. So far only a limited number of scientific research papers are available. Most are based on experiments with a limited number of samples, not comprising the full range of seed qualities that can be encountered in the market place, as also indicated before by Matthews *et al.* (2011).

A comparative study among labs for carefully selected seed samples could be the next step forward. A number of issues and

questions will have to be addressed in such a comparative study:

1. Chlorophyll level is related to germination quality. Does this relationship change during storage of the seed? Is it influenced by disease, seed coating products, priming, production location, production year, other variable seed properties (e.g. seed moisture content, seed (coat) oxidation level), or variety?
2. CF readings could be influenced by cracks in seed coats. It is not known to what extent this could happen.
3. The seed chlorophyll content can be affected by cryopreservation (Cejas *et al.*, 2012). To what extent, and in which species?
4. Which alternative methods exist (e.g. Breia *et al.*, 2013, Ooms *et al.*, 2011, Nakajima *et al.*, 2012). Can all these methods be calibrated, in order to have a method validation and not an equipment validation?

Depending on the outcome of one or more comparative studies, the CF method could qualify for incorporation into the ISTA Rules or an ISTA Handbook.

Conclusion

Chlorophyll fluorescence is a promising sensitive, fast and non-destructive new technology for use in the production, cleaning, upgrading and testing of seed. More research and comparative studies will give further insight into possibilities for this method to be included in the ISTA Rules or an ISTA Handbook.

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Introduction of new methods: spectral imaging

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Speed, accuracy and costs are important aspects of seed testing methods. Hence, the possibilities to introduce new methods in seed testing that provide improvements on these aspects as well as additional information on seed quality parameters are of great interest. In this respect, spectral imaging technology can be seen as a methodology which can add to the knowledge of seed quality aspects, the speed of testing and the reproducibility of traditional tests within and between laboratories. Seed size, shape and colour are common features that are employed as sorting parameters for improvement of seed quality. Features can be extracted from images captured at different wavelengths. These features provide a new opportunity of determining seed quality parameters such as morphological and biochemical characteristics of the seed coat, for example the presence of waxes, pectin and phenols.

What is spectral imaging?

Images of an object exposed to light of different wavelengths can be obtained by digital cameras. In general, digital cameras capture three different images: a red, a green and a blue (RGB) colour image, by using three different sensors (for red, green and blue light). The combination of these images produces a colour picture. When images of for example green seeds are taken by such a camera, the sensors will detect the green colour because green light waves are reflected by the seeds, whereas blue and red light waves are absorbed.

In spectral imaging the sequential exposure of the object to light of different wavelengths provides further information about topographical texture, spectral texture and gloss. An example of this is the possibility to distinguish between the presence of chlorophyll a and b by the use of specific wavelengths in the region of 400–500 nm and 600–700 nm, which would not be detected in the traditional colour image (RGB). A spectral image primarily provides information on properties originating in the surface chemistry and structure.

In multispectral imaging, several images are taken in selected bands of wavelengths; each represents an individual wavelength, depending on the selected light sources and optical filters. An example of such a measuring device is shown in Figure 1.

Hyperspectral imaging deals with several images that cover a complete spectral range with a specific interval between each wavelength.

Current multispectral imaging systems will typically use light emitting diodes (LEDs) as light sources with wavelength bands of 10–25 nm width (FWHM), whereas hyperspectral systems use broadband light sources covering the full spectral range and then separate the wavelength on the camera side, e.g. using a diffraction grating.

Hyperspectral imaging is of interest from a research perspective to increase the knowledge about selecting wavelengths that can be used in quality testing, but the extra spectral information often comes as a trade-off of spatial resolution, dynamic range and/or speed of acquisition. By using multispectral imaging it is possible to apply only those bands which are valuable in discriminating between the required traits of the seed.

Advances resulting from the use of a system in which selected frequencies of wavelengths are employed (e.g. by LED, as in Fig. 1) are opportunities to determine the presence of specific biochemical compounds in or on the surface of the seed, fungi or seedling. These may be various pigments, wax, chlorophyll or fatty acids. Furthermore, taking of images by use of near-infrared (NIR) wavelengths provides opportunities to separate features that cannot be done visually (Singh *et al.*, 2007), like lipids, proteins and carbohydrates.

Table 1 lists compounds that can be correlated to various wavelengths.

Table 1. Correlations between wavelength, colour and compound types, when objects (e.g. seeds) are illuminated by different types of LEDs

Wavelength (nm)	Colour	Compound / application example
375	UVA	Fluorescence, mycorradicin (Klingner *et al.*, 1995)
405	Violet	Melanins (Nosanchuk *et al.*, 1998)
435	Indigo	Chlorophyll a (absorption and excitation)(Salisbury and Ross, 1992)
450	Blue	Riboflavin, chlorophyll b, β-carotene (Salisbury and Ross, 1992)
505	Cyan	Metmyoglobin (Govindarajan and Snyder, 1973)
525	Green	Anthocyanin (Vivar-Quintana *et al.*, 2002)
570	Yellow	Oxymyoglobin (Schenkman *et al.*, 1997)
590	Amber	Oxymyoglobin (Schenkman *et al.*, 1997)
630	Red	Metmyoglobin (weak)(Govindarajan and Snyder, 1973)
645	Red	Chlorophyll b (Salisbury and Ross, 1992)
660	Red	Chlorophyll a (Salisbury and Ross, 1992)
850	NIR	Light-harvesting complex 1 (LH2)(Tharia *et al.*, 1999)
890	NIR	Fat (Song *et al.*, 2009)
940	NIR	Fat (Song *et al.*, 2009)
970	NIR	Water (Penuelas *et al.*, 1993)

Parameter correlations and classification of seed quality

Parameter determinations and parameter correlations on non-homogeneous seed samples or the use of a combination of different parameters to distinguish classes require highly trained and experienced personnel. The use of image analysis technology which can mimic human vision will eliminate subjective assessment, and also provide documentation. However, this type of imaging technology mostly requires more spectral information than the RGB image.

When dealing with multi-dimensional data, as generated in multispectral images, reduction of the data dimensions is required to visualize and find natural groupings within the data set. Data reduction can be achieved by various mathematical methods which transform multispectral images into new images with reduced numbers of bands. If the various groups within the samples are unknown, it can be valuable to apply unsupervised data analysis methods, such as principal component analysis (PCA). Examples of this approach were published in studies by Singh *et al.* (2007) and Zhang *et al.* (2012). In some cases, such as in the case of canonical discriminant analysis (CDA), the multispectral images can be reduced to only one band image. CDA is also known as Fisher's linear classifier and is defined as a supervised transformation, because it is based on known groups used as training samples (e.g. fungi and uninfected seeds).

Examples of the possibilities of spectral imaging in seed quality testing are described below.

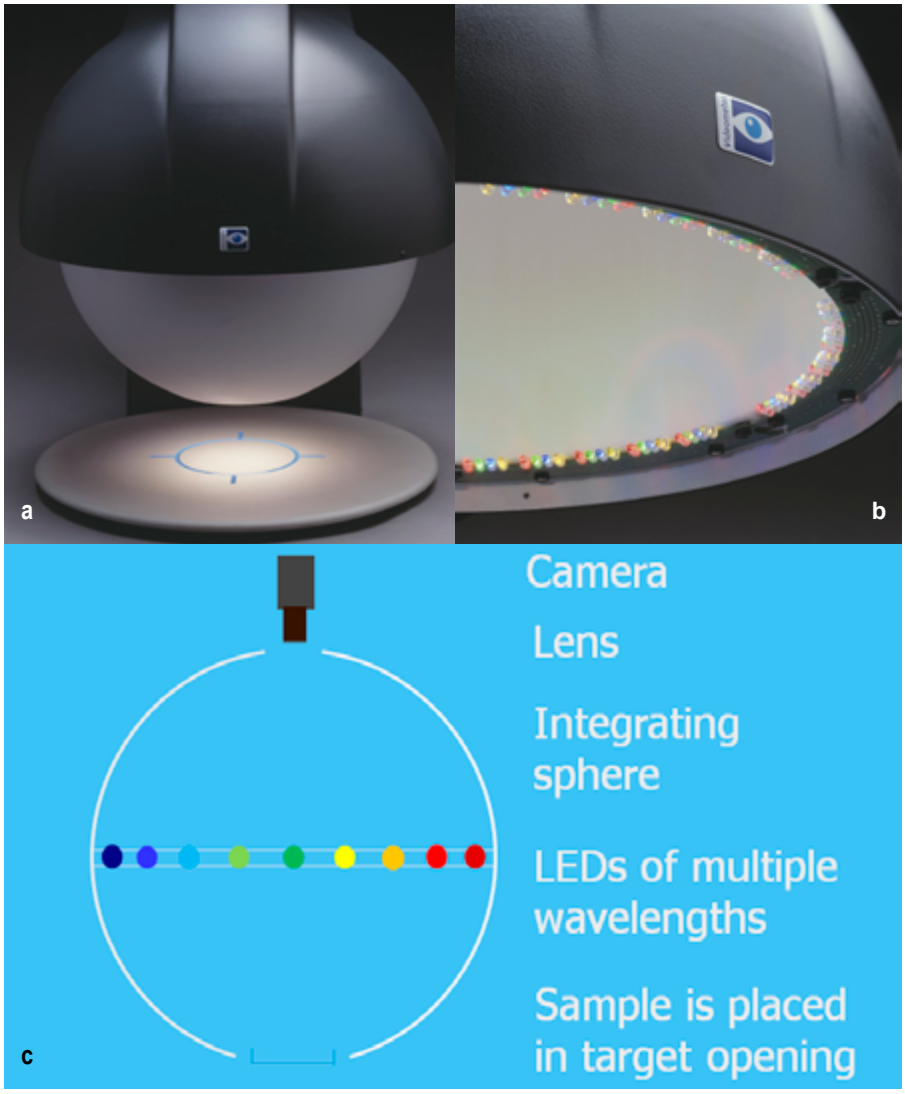

Figure 1. Example of a multispectral imaging tool (**a**), consisting of an array of LED light sources providing light of 19 different wavelengths (colours in the range of 405–970 nm) that illuminate the seed sample (**b**). A 5 megapixel camera captures the reflection images of the sample for the various wavelengths consecutively (**c**). The whole set-up is placed inside a sphere to achieve homogenous illumination. Thus, the camera takes 19 greyscale images with a spatial resolution of 2056 × 2056 pixels, taken at wavelengths from 405 to 970 nm. The camera is connected to a computer, which handles the images as 19 two-dimensional matrices of numbers. Each of these matrices represents the reflectance data from each of the 19 wavelengths. Each of the numbers in each matrix represents the reflectance value in one particular image pixel.

Purity

Determination of purity of seed lots in seed testing is often time consuming, and for some species difficult. This is especially the case for seed lots in which the seeds of different subspecies (e.g. *Brassica* species) can hardly be distinguished visually. Multispectral imaging analysis may provide tools for distinguishing species and varieties. In maize and grape, spectral imaging has been used to distinguish varieties based on the optical spectral features of the seeds (Zhang *et al.*, 2012; Rodríguez-Pulido *et al.*, 2013). For maize, the optimal wavelengths for distinguishing the groups (i.e. varieties) in a principal component analysis (PCA) were 523, 579 and 863 nm. Measurements on these three wavelengths allowed the varieties in the batch to be clearly distinguished.

Germination and vigour

Monitoring of seed germination by imaging has been employed in a number of studies. Multispectral imaging may contribute to identifying morphological and biochemical features of the seed or radical that can provide valuable information relating to germination and seed vigour. Image analysis has proven to be a valuable tool in germination testing and monitoring of germination curves, as discussed by Matthews and Powell (2012), Dell'Aquila (2004, 2005) and Wagner *et al.* (2012), and determination of pregerminated barley (Arngren *et al.*, 2011).

Seed health

In a multispectral imaging approach, the combinations of the features from images

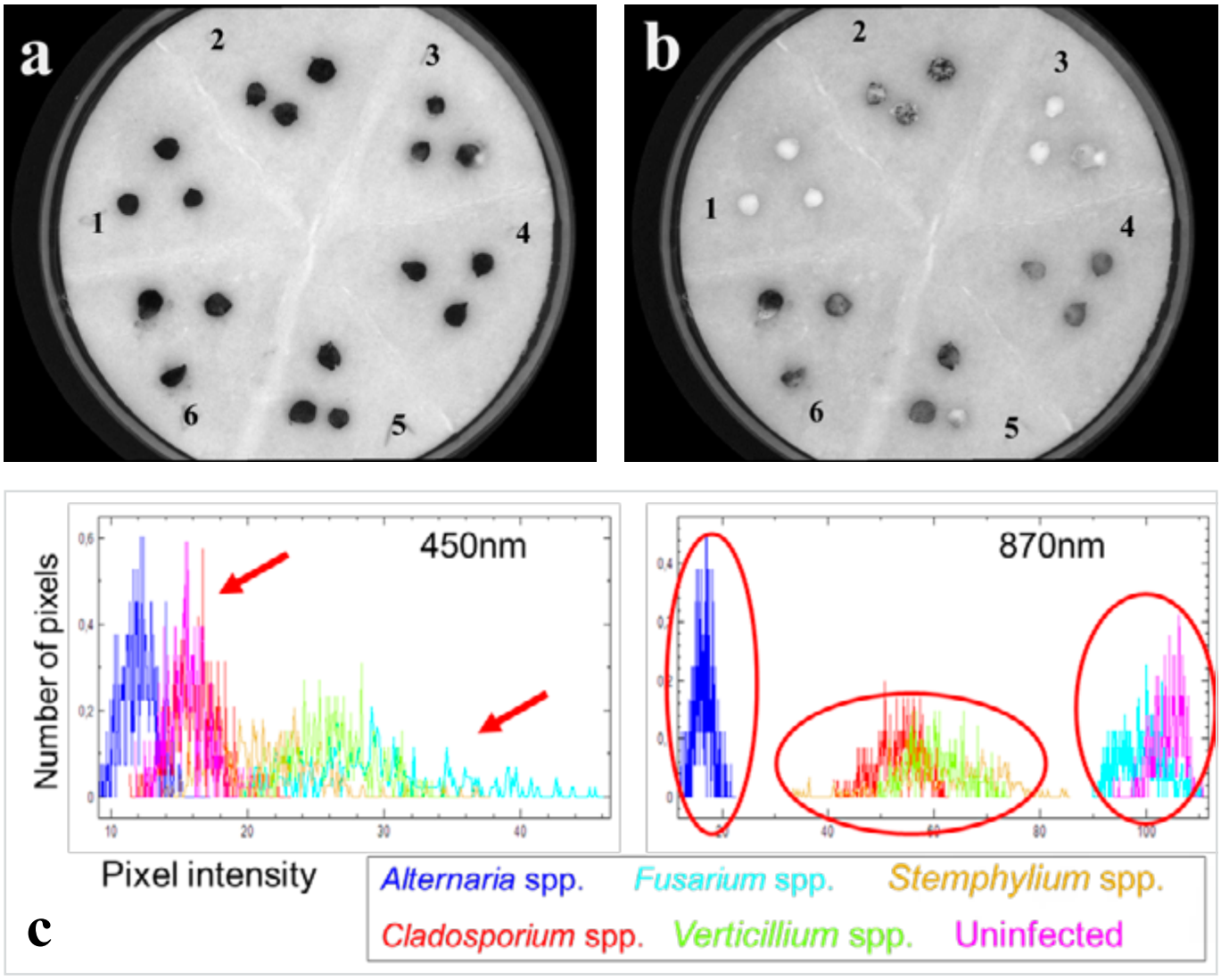

Figure 2. Images of spinach seeds taken with the VideometerLab multispectral imaging tool at 450 nm **(a)** and 870 nm **(b)**, and data analysis of the images. 1: uninfected; 2: *Stemphylium botryosum*; 3: *Fusarium* spp.; 4: *Cladosporium* spp.; 5: *Verticillium* spp.; 6: *Alternaria alternate*. **c** Average reflectance distribution for each seed group under light of wavelengths of 450 nm and 870 nm. The distribution is given as the number of pixels with different pixel intensities. At 870 nm, all infected seeds, except for the *Fusarium*-infected seeds, can be distinguished from uninfected seeds. In combination with 450 nm, the *Fusarium*-infected seeds can also be detected.

captured by visible light wavelengths and NIR wavelengths were shown to be valuable in separating uninfected spinach seed from seeds infected by *Stemphylium botryosum*, *Cladosporium* spp., *Fusarium* spp., *Verticillium* spp. or *Alternaria alternate* (Fig. 2; Olesen *et al.*, 2011).

Images of the spinach seeds, taken with visible light (e.g. 450 nm), resulted in pixel values that could not be grouped to distinguish between infected and uninfected seeds (Fig. 2, left). However, when NIR wavelengths (e.g. 870 nm) were used, it was possible to group the seeds into three distinct groups. Thus, all seeds infected by fungi, except by *Fusarium* spp., could be separated from the uninfected seeds (Fig. 2, right). By studying the visible light images (Fig. 2, left) it can be concluded that the *Fusarium* spp.-infected seeds can be distinguished from the uninfected seeds by the visible light wavelengths. Hence, by using both visible and NIR wavelengths it is possible to separate the uninfected seeds from seeds infected by *Stemphylium botryosum*, *Cladosporium* spp., *Fusarium* spp., *Verticillium* spp. or *Alternaria alternate*.

A similar approach was employed in a study on malting barley (Bodevin *et al.*, 2009). In this study, a calibration model was developed for detecting *Fusarium* spp. on barley. The common, but time-consuming, ELISA and real-time PCR methods used for detecting fungi were compared with the multispectral imaging analysis method. The aim of the study was to evaluate the correlation between the three methods. 48 samples from seed lots with infections between 1 and 30 % were analysed by the use of ELISA, real-time PCR and multispectral imaging (18 wavelengths ranging from 405 to 970 nm). High correlations were found between results from PCR and multispectral imaging (R^2 = 0.85), in contrast to the correlations between ELISA and imaging (R^2 = 0.3) and ELISA and PCR (R^2 = 0.2).

Conclusion

New methods for seed testing are emerging with increasing technological possibilities and computer power, parallel to decreasing prices for such systems. Multi- and hyperspectral imaging and analysis of the generated data are clear examples of these developments. The light sources, cameras and computers for such systems are readily available and relatively affordable. This opens a wide array of potential applications in seed testing at various levels, as well as research opportunities that before were only possible for a few very specialized institutions. The example of the possible use of multispectral imaging in seed quality testing shows that this technology has a lot to offer to the seed testing community. However, the major testing, comparing and validation still has to be done. Nevertheless, we may expect multispectral and hyperspectral imaging to be part of the standard seed testing equipment in the near future.

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7th ISTA Seed Health Symposium

Edinburgh, United Kingdom, 12–14 June 2014

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The Organising Committee is proud to invite you to the 7th ISTA Seed Health Symposium on 12–14 June 2014 in Edinburgh. The symposium provides a unique opportunity to bring together scientists, technicians, managers and policy makers from research institutes, government, the seed trade, and international organisations who are involved with the health status of seed.

The programme will be of a high technical and scientific quality discussing the latest scientific research on seed-borne pathogens; progress in seed health testing; and (both) phytosanitary and practical issues confronting the industry worldwide.

Finally, we hope Edinburgh will provide an ideal environment for scientific exchange and hospitality. We will do all we can to ensure your visit is a pleasant one.

Venue

The 7th Seed Health Symposium will take place from 12 to 14 June 2014 at the National Museum of Scotland, in the heart of Edinburgh and within walking distance of the railway station and local hotels.

Registration

ISTA Members: GBP 220
Non-members: GBP 255
Students: GBP 75
Exhibitors: GBP 1250

Registration can be made through the ISTA web site. Registration includes tea and coffee breaks, lunches, dinner barbecue (Friday evening) and visit to the Royal Botanic Garden.

Sponsors and exhibitors

There are possibilities to sponsor the 7th ISTA Seed Health Symposium, with a variety of sponsoring packages to choose from.

Reach seed health professionals from laboratories and organisations in the UK and worldwide. Only a limited number of exhibition stands are available. The exhibitor registration fee includes one exhibitor for the duration of the Seed Health Symposium as well as coffees, lunches and dinner barbecue.

For detailed information about sponsorship and/or exhibiting, please contact Valerie Cockerell (valerie.cockerell@sasa.gsi.gov.uk).

More information

For more details please visit the ISTA web site at www.seedtest.org/SHS ■

The Symposium venue: the National Museum of Scotland, Chambers Street, Edinburgh

Programme

Venue: National Museum of Scotland, Chambers St., Edinburgh

Thursday, 12 June 2014

13:00–17:00 Registration desk open

13:00–16:45 ISTA Seed Health Symposium Day 1

13:00–13:45 Tea and coffee

13:45–14:00 Opening of the Symposium

Welcoming address of the Chair of the National Organising Committee
Valerie Cockerell, SASA, UK
Welcoming address of the Secretary General of ISTA Beni Kaufman

14:00–14:30 Invited Speaker: Françoise Petter, EPPO
EPPO activities with a special focus on seed-borne pests

14:30–15:15 Session 1: Seed-borne diseases transmission and epidemiology Chair: Terry Aveling, University of Pretoria, South Africa

***Ramularia collo-cygni* – an emerging seed-borne pathogen of barley**
Neil Havis, Kalina Gorniak, Gareth Hughes and Fiona Burnett, SRUC, UK

Virulence pattern in Danish races of common bunt (*Tilletia caries*)
Anders Borgen, Agrologica, Denmark

Coriander bacterial blight: predicting the risk and defining seed health standards
Steve Roberts, Plant Health Solutions Ltd., UK

15:15–15:45 Coffee break

15:45–16:30 Session 1 (continued)

Common bunt caused by *Tilletia caries*: epidemiology study and set up of a protocol to assess transmission to plantlets and damage threshold G Orgeur, A Delaunay, I Sérandat, F Decugis, M Rolland, J Gombert, M Fontaine, R Vallade and V Grimault, GEVES, France

The effect of *Microdochium nivale* and *M. majus* on the establishment of barley and oats
Marian McNeil, Tina Langan and Valerie Cockerell, SASA, UK

Comparison of infection and seedling disease caused by wild-type and Tri6 mutant strains of *Fusarium graminearum*
T Bruns and G Munkvold, Iowa State University Seed Science Center, USA

16:30–16:45 Session 1 discussion, questions and answers

Friday, 13 June 2014

08:30–09:00 Registration desk open

09:00–17:00 ISTA Seed Health Symposium Day 2

09:00–09:25 Invited Speaker: Ruud Scheffer, ISF
Seed health and the International Seed Health Initiative: status and challenges

09:25–10:25 Session 2: Test method standardisation and laboratory evaluation
Chair: Valérie Grimault, GEVES, France

Detection of pospiviroids in seeds of tomato and pepper
Harrie Koenraadt, Ko Verhoeven, André van Vliet, Agata Jodlowska, Michel Ebskamp and Maaike Bruinsma, Naktuinbouw, the Netherlands

Sample preparation of artificial infected chili seed (*Capsicum annum*) by *Colletotrichum capsici* for seed health proficiency testing
Tri Susetyo, Amiyarsi Mustika, Siti Fadhilah and Endang Murwantini, PPMB-TPH, Indonesia

Rapid method for the detection of *Sclerotinia sclerotiorum* on soybean seeds
E Grabicoski, D Jaccoud Filho, M Pileggi, L Henneberg, C Vrisman, M Pierre, F Cantele, H Sartori, G Tullio, C Hüller and C Wutzki, State Universiy of Ponta Grossa, Brazil

ISTA seed health proficiency testing developments Valérie Grimault, GEVES, France

10:25–10:55 Coffee break

10:55–11:25 Session 2 (continued)

Development of a molecular assay for the detection of *Xanthomonas campestris* pv. *campestris* in *Brassica* seeds
Maaike Bruinsma, André van Vliet and Harrie Koenraadt, Naktuinbouw, the Netherlands

Development of IPPC standards
Jane Chard, SASA, UK

11:25–11:35 Session 2 discussion, questions and answers

11:35–12:30 Poster session
Chair: tbc

12:30–13:40 Lunch

13:20–14:50 Session 3: Seed treatments for conventional and organic seed production
Chair: Neil Havis, SRUC, UK

Seed treatment effects on maize seedling infection by *Spacelotheca reiliana* measured by real-time PCR
S Anderson and G Munkvold, Iowa State University Seed Science Center, USA

Efficacy of selected rhizobacterial isolates for enhanced seed germination, vigour and seedling growth of maize and biocontrol of *Rhizoctonia solani* N Rudolph, T Aveling and N Labuschagne, University of Pretoria, South Africa

Seed borne inoculum of *Sydowia polyspora* may cause infection in conifer seedlings
Guro Brodal, Eleonora Høst, Heidi Røsok Bye, Arne Stensvand and Venche Talgø, Bioforsk, Norway

Biopriming of chickpea (*Cicer arietinum* L.) seed for enhanced seedling vigour and protection against wilt pathogen
Sandeep Kumar Lal, Shiv K Yadav, P Nallathambi and Manoj Kumar, Indian Agricultural Research Institute, India

The influence of seed infection by *Alternaria* spp. on sunflower (*Helianthus annuus* L.) seed germination and control using fungicides as a bio-control agent
G Kgatle, T Ramusi, M Truter, B Flett and T Aveling, University of Pretoria, South Africa

Seed treatments and seedling root soaking with biological agents controlled *Xanthomonas oryzae* pv. *oryzae* and improved growth of rice plants in greenhouses
Satriyas Ilyas, Kirana Lizansari and Muhammad Machmud, Bogor Agricultural University, Indonesia

14:50–15:00 **Session 3 discussion, questions and answers**

15:00–15:30 Coffee break

15:30–16:45 **Session 4: Emerging diseases and climate change**
Chair: Jane Thomas, NIAB, UK

Emerging pathogens of leafy vegetables transmitted through seeds in Italy
Giovanna Gilardi, Stefano Demarchi, Maria Lodovica Gullino and Angelo Garibaldi, AGROINNOVA, Italy

The occurrence of *Fusarium* in cereal seeds in Norway 1970-2012 and the relationship with climatic conditions
Guro Brodal, Trond Rafoss and Håkon Tangerås, Bioforsk, Norway

Contributions of seed health quality to the dissemination and diagnosis of *Sclerotinia* disease in soybean crops in Brazil
J Machado, L Silva, E Barrocas, W Zancan and M Salgado, Federal University of Lavras, Brazil

Occurrence of *Fusarium langsethiae* on oat kernels in Italy
M Dal Prà, S Tonti, M Montanari, E Stafani and I Alberti, University of Modena and Reggio Emilia, Italy

Examinations on the *Phomopsis* complex on soya beans (*Glycine max*) obtained from Austrian seed production areas
Manfred Weinhappel and Angela Weingast, Austrian Agency for Health and Food Safety, Austria

16:45–17:00 **Session 4 discussion, questions and answers**

17:00 **Departure for visit and barbecue at the Caledonian Hall, Royal Botanic Gardens, Edinburgh**

Saturday, 14 June 2014

09:00–12:00 **ISTA Seed Symposium Day 3**

09:00–09:25 **Day 3 Invited Speaker: tbc**
Presentation title tbc

09:25–10:25 **Session 5: Traditional and modern approaches for the evaluation of seed health**
Chair: Gary Munkvold, Iowa State University Seed Science Center, USA

***Ditylenchus dipsaci* on alfalfa seeds: obtaining and testing for healthy seeds**
I Sérandat, V Grimault, V Blouin, J Gombert, E Lesprit, C Sarniguet, M Straëbler, H Lemaire and G Forsberg, GEVES, France

Do we need a new sampling plan for seed health? Roy MacArthur and Valerie Cockerell, Fera/SASA, UK

Malting barley grain mycoflora studied by Videometer multispectral imaging and next generation barley sequencing
Mogens Nicolaisen, Søren Knudsen, Merete Halkjær Olesen, Birte Boelt, Kim Jørgensen and Jens Michael Carstensen, Aarhus University, Denmark

Videometer demonstration
Jens Michael Carstensen, Videometer A/S

10:25–10:55 Coffee break

10:55–11:35 **Session 5 (continued)**

Developing MiSeq Next Generation Sequencing for pathogen screening in seeds
Adrian Fox, Ian Adams, Ummey Hanny, Toby Hodges and Victoria Barton, Fera, UK

Seed health test for bacterial fruit blotch in cucurbits using sweat-bag seedling method
Masatoshi Sato, Hiroki Takahashi and Takashi Shirakawa, National Center for Seeds and Seedlings, Japan

11:35–11:50 **Session 5 discussion, questions and answers**

11:50–12:00 **Overview and Conclusion of Symposium**

12:00 Packed lunch and departure

ISTA Annual Meeting 16-19 June 2014

EDINBURGH

ISTA Annual Meeting 2014 Edinburgh, United Kingdom 16–19 June 2014

Overview

Thursday–Saturday 12–14 June	7th ISTA Seed Health Symposium (see page 14)
Sunday 15 June	Day tour to Kingdom of Fife (see page 21) Welcome reception
Monday 16 June	Opening ceremony
Monday 16 June	ISTA Sampling Seminar
Tues–Wed 17–18 June	Presentation of ISTA's technical work (see page 18)
Wednesday 18 June	Official Dinner
Thursday 19 June	ISTA Ordinary General Meeting (see page 18)
Friday 20 June	Tour to Royal Highland Show (see page 21) Visit to SASA (morning; see page 21)
Monday–Thursday 23–26 June	ISTA Seed Sampling Workshop (fully booked)

Above: Edinburgh Castle, viewed from Princes Street Gardens.

Top: Forth Rail Bridge

ISTA Annual Meeting 2014, Edinburgh, UK, 16–19 June 2014
Online registration: www.seedtest.org/AM14

EDINBURGH

ISTA Annual Meeting

16-19 June 2014

Programme

Venue: Assembly Rooms, George Street, Edinburgh

Unless otherwise stated, all activities mentioned in the programme will be held at the venue

Sunday, 15 June 2014

16:00–19:00	Registration of participants at conference venue
19:00	**Welcome reception**

Monday, 16 June 2014

08:00–18:00	Registration of participants at conference venue
08:30–17:45	**ISTA Sampling Seminar**
08:30–09:00	**Opening** Valerie Cockerell, SASA, UK **Introduction** Joël Léchappé, ISTA President **Introduction** David Barnes, Deputy Director of Agriculture, Food and Rural Communities, Head of Agriculture and Rural Development
09:00–09:15	**Introduction to the Sampling Seminar** Eddie Goldschagg, SANSOR, South Africa
09:15–10:15	**Session 1: Relevance of seed sampling for seed testing statistics** Michael Kruse, University of Hohenheim, Germany **Sampling as a source of variation in ISTA tolerances** Michael Kruse **Practical examples for monitoring the performance of sampling and sampling tools** Peter Deplewski, University of Hohenheim, Germany
10:15–10:45	Tea break
10:45–11:45	**Session 2: New methods/developments in seed sampling** Steve Jones, Canadian Food Inspection Agency, Canada **Validation of new methods and equipment for sampling purposes** Steve Jones **Optimizing sampling plans for seed transmitted pathogens** Roy MacArthur, Food and Environment Research Agency; Valerie Cockerell; Jean-Louis Laffont, Pioneer Génétique, France **Automatic seed sampling** Lotta Claesson, Swedish Board of Agriculture, Sweden
11:45–12:45	**Session 3: Quality assurance in seed sampling** Rasha El-Khadem, ISTA Secretariat, Switzerland **Why is quality assurance essential in seed sampling** Eddie Goldschagg **How to respond to non-conformities** Rasha El-Khadem **Evaluation of suppliers and of supplied equipment** Jette Nydam, Nordic Genetic Resource Center, Sweden
12:45–14:00	Lunch break, view equipment
14:00–14:40	**Training, examination and authorization of seed samplers** Dot Vittrup Pedersen, DLF-Trifolium A/S, Denmark **Monitoring of seed samplers** Leena Pietilä, Finnish Food Safety Authority, Finland
14:40–15:45	**Session 4: Panel Debate: Monitoring of seed samplers and seed sampling equipment** Joël Léchappé (panel members to be announced) Questions to the panel members
15:45–16:15	Tea break, view equipment
16:15–17:15	**Session 4: Panel Debate (continued)**
17:15–17:30	**Summary of the debate** Beni Kaufman
17:30–17:45	**Closing of the Seminar** Eddie Goldschagg

Tuesday, 17 June 2014

08:00–18:00	Registration of participants at conference venue
08:30–18:30	**Presentations of ISTA's technical work and meetings of ISTA Technical Committees**
08:30	**Opening by the ISTA President, Joël Léchappé (France)**
08:30–10:00	Purity Committee (Chair: Jane Taylor) Germination Committee (Chair: Sylvie Ducournau) Moisture Committee (Chair: Jette Nydam)
10:00–10:30	Coffee break
10:30–12:30	Tetrazolium Committee (Chair: Stefanie Krämer) Seed Vigour Committee (Chair: Alison Powell) Seed Health Committee (Chair: Valérie Grimault) Variety Committee (Chair: Ana Laura Vicario)
12:30–13:30	Lunch break
13:30–14:00	GMO Committee (Chair: Cheryl Dollard)
14:00–15:00	Flower Seed Committee (Chair: Rita Zecchinelli) Forest Tree & Shrub Seed Committee (Chair: Fabio Gorian)
15:00–15:30	SST Editorial Board (Chair: Fiona Hay)

15:30–16:00	Coffee break and official photo session
16:00–18:30	Individual ISTA Technical Committee meetings
19:00	**Whisky tasting (free of charge)**

Wednesday, 18 June 2014

08:00–17:00	**Presentations of ISTA's technical work (cont.)**
08:30	Opening by the ISTA President, Joël Léchappé
08:30–10:00	Bulking and Sampling Committee (Chair: Eddie Goldschagg) Statistics Committee (Chair: Jean-Louis Laffont) Nomenclature Committee (Chair: John Wiersema)
10:00–10:30	Coffee break
10:30–11:30	Seed Storage Committee Chair: (Hugh Pritchard) Advanced Technologies Committee (Chair: Bert van Duijn)
11:30–12:30	Proficiency Test Committee (Chair: Günter Müller) Laboratory Accreditation and Quality Assurance Programme (Chair: Rasha El-Khadem)
12:40–13:30	Lunch break
13:30–15:30	Rules Committee (Chair: Steve Jones)
15:30–16:00	Coffee break
16:00–18:00	Rules Committee (cont.)(Chair: Steve Jones)
19:00–23:00	**Official Dinner**

Thursday, 19 June 2014

09:00–17:30	**ISTA Ordinary General Meeting**
09:00–09:30	**Welcome by the ISTA President, Joël Léchappé** **Welcome on behalf of the Scottish Government by Dr. Kevin O'Donnell, Deputy Director of Agriculture, Food and Rural Communities, Head of Science and Advice for Scottish Agriculture (SASA)**
09:30–10:00	**Presentation on behalf of Scottish Industry by Mr. Kevin Mills, Scottish Policy Manager, Agricultural Industries Confederation Scotland**
	Agenda
10:30–12:30	1. Call to order 2. President's address 3. Roll call of Designated Members entitled to vote 4. Comments about the minutes of the previous General Meeting 5. Report of the Executive Committee 6. Report of the Secretary General
12:30–13:30	Lunch break
13:30–15:00	7. Fixation of annual subscriptions 8. Changes to the Articles (see page 22) 9. Consideration and adoption of the proposed Rules changes 2015
15:00–15:30	Coffee break
15:30–17:30	10. Consideration and adoption of reports 11. Announcement of the places and dates of the next Ordinary General Meetings 11.1 Annual Meeting 2015 11.2 Congress and Seed Symposium 2016 12. Any other business raised by a Member, of which notice in writing has been received by the Secretary General at least two months prior to the date of the General Meeting 13. Any other business raised by consent of the Executive Committee 13.1 Discussion on the late payment of membership fee system and late fees charge 14. President's closing address 15. Adjournment

Preparatory documents for Ordinary General Meeting: see page 22.

Meeting venue

The meeting will take place in the Assembly Rooms, George Street, in the centre of Edinburgh's World Heritage site. The Assembly Rooms opened in 1787. Throughout its history the venue has catered for balls, music festivals, banquets and Royal Occasions, as well as conferences.

The venue has recently undergone an eighteen month refurbishment resulting in modernised spaces which retain the buildings character and beauty. The venue provides the perfect space for the ISTA Annual Meeting 2014 with state of the art lighting and sound systems throughout and in house audio visual and wireless internet.

Edinburgh

The City of Edinburgh, Scotland's inspiring capital city, is one of the leading cities in the world in which to visit. Explore the fascinating cobbled streets of the medieval old town of this UNESCO World Heritage City and stroll across to the elegant New Town to marvel at James Craig's stunning architecture.

The Botanic Garden offers a wondrous experience in an oasis of plants and trees or visit the Giant Pandas at Edinburgh Zoo. Wherever you choose to visit, the backdrop of Arthur's Seat, the Pentland Hills and Edinburgh Waterfront make the city a unique visitor destination.

For further information on Edinburgh and Scotland please visit:
www.edinburgh-inspiringcapital.com
and
www.visitscotland.com

Flight information

There are direct flights from many European cities to Edinburgh, and Edinburgh is approximately a 1 hour 15 minute flight from London. The taxi fare from the airport to Edinburgh city centre will cost approximately £16–20. There is also an airport bus every 10 minutes that heads directly to the city centre which may be a cheaper option at £3.50 depending on the

hotel you have chosen. See the link below for Edinburgh airport and up to date information:
http://www.edinburghairport.com/
transport-and-directions/
travel-into-edinburgh-city

Representatives from SASA will be available at the airport to advise on the best form of transport for you and to try to answer any other questions you may have on arrival (depending on your flight arrival time).

Climate

Edinburgh in June enjoys temperatures in the range of 10–20 °C and the average rainfall for the month is 50 mm. The Scottish weather can be changeable and is often localised. This means you may well have a morning of rain and an afternoon of sunshine, and that the weather may be quite different 10 miles away. So remember to pack your waterproof or an umbrella and something to keep you warm as well as sun cream! The days are at their longest in June, and with 17 hours of daylight there is plenty of time to enjoy your visit.

Registration fees (online registration at www.seedtest.org/AM14)

Periods	Events	Registration fees (15 March–15 May 2014)
ISTA Members		
16–19 June	Annual Meeting incl. Seminar	GBP 660
16 June	Seminar only	GBP 225
Non-members		
16–19 June	Congress incl. Seminar	GBP 990
16 June	Seminar only	GBP 340
Students		
16 June	Seminar only	GBP 50
Accompanying persons		
16–19 June	Social events, lunches etc. only	GBP 200
Exhibitors (incl. 1 person)		
16–19 June	Exhibition booth	GBP 3000

Currency and exchange

The currency in Scotland is the pound Sterling (£), and the exchange rates are approximately £1 to 1.47 USD or £1 to 1.21 Euros.

Visas

Visitors are advised to check with the UK Border Agency (http://www.ukba.homeoffice.gov.uk) for visa requirements. A letter of invitation can be requested upon successful registration and payment from the ISTA Secretariat.

Post-Meeting tour, Friday, 20 June: Highland cattle at the Royal Highland Show.

Accommodation

A variety of accommodation is available in central Edinburgh from student accommodation to 4 star hotel accommodation. Marketing Edinburgh has negotiated rates for the International Seed Testing Association Annual Meeting 2014 and the 7th ISTA Seed Health Symposium) and is pleased to offer a free online accommodation booking service to delegates attending this meeting.

To view and book the various accommodation options please use the link below: https://cabs.conventionedinburgh.com/ei/

Credit card details are required to make a booking, and confirmation shall be sent to your e-mail address. Payment is paid directly to the accommodation provider at the time of your stay.

To contact Marketing Edinburgh, either e-mail bookings@conventionedinburgh.com or telephone on +44 (0) 131 473 3874.

Please note that there is no organised transport from the hotels to the ISTA Meeting venue. There is an excellent public transport system if you do not wish to walk. Directions to the ISTA Meeting venue and details of suitable public transport from your hotel will be waiting for you in your room (if booked through the above link).

Book early as accommodation in Edinburgh is very popular during the summer months!

The giant panda Tian Tian at Edinburgh Zoo. (Photo: Chris Keating)

Tours and visits

All visits listed below will go ahead. Final details will be confirmed with participants nearer the time.

Visit the Kingdom of Fife!

Sunday 15 June 2014 (full day 09:00 to 18:00)

Stopping at South Queensferry to view the Forth Rail Bridge, then follow the coastal route through picturesque old fishing villages in the East Neuk to the Medieval City of St. Andrews, home of golf. Enjoy free time and lunch in St. Andrews. Finally, the tour will head to the village of Falkland, home of James V's renaissance palace, before heading back to Edinburgh.

Cost: £40 (includes guide and entrance to Falkland Palace, excludes lunch).

Visit to the Royal Highland Show

Friday 20 June 2014 (full day 09:30 to 16:30)

This agricultural show has a worldwide reputation for showcasing the very best of Scottish food, farming and culture.

The visit to the Royal Highland Show will go ahead, and we hope you will enjoy everything it has to offer from cows to combine harvesters and much more! We are still trying to get the best deal on entry tickets.

Cost: £35 estimate (includes entry to Show and bus to and from central Edinburgh)

Visit to Science and Advice for Scottish Agriculture

Friday 20 June 2014 (morning)
Cost: free

Please register your interest when you register, and we will be in touch with details in May once final numbers are received.

Whisky tasting (free of charge; Tuesday, 17 June, 19:00)

EDINBURGH

ISTA Annual Meeting

16-19 June 2014

Preparatory documents for the Ordinary General Meeting

The following documents are submitted to the ISTA Ordinary General Meeting 2014 for information and discussion and/or acceptance by the nominated ISTA Designated Members voting on behalf of their respective Governments:

- OGM14-01 Agenda for the Ordinary Meeting 2014 [information document]
- OGM14-02 Minutes of the Ordinary Meeting 2013 [information document]
- OGM14-03 Activity Report of the ISTA Committees 2013 [voting document]
- OGM14-04 Proposal for the Membership Fees 2014 [voting document]
- OGM14-05 Rules Proposals for the International Rules for Seed Testing 2015 Edition [voting document]
- OGM14-06 Method Validation Reports on Rules Proposals for the International Rules for Seed Testing 2015 Edition [supporting document to voting document OGM14-05]
- OGM14-07 Article Change Proposals 2014 [voting document]
- OGM14-08 Discussion Paper on In-house Methods [information document]

Please note that no paper copies of the meeting documents will be available at the meeting.

The documents have been posted on the ISTA web site at:
www.seedtest.org/OGM14

Proposal to change the Articles of ISTA

A change to the Articles of ISTA is being proposed for voting at the 2014 Ordinary General Meeting. The full document "OGM14-07 Article Change Proposals 2014" was sent to the Members in April, two months before the OGM.

The proposed change is summarized below.

Article Change Proposal OM14-07-1: To change the corporate membership category from a single membership to one that allows for different levels of membership depending on the size (number of employees) of the organization.

ISTA has had Corporate Membership since 2007. To date there have been no Corporate Members. To encourage corporate membership we need to review the structure of the corporate membership category.

A corporation (company) may vary in size from a few employees to many hundreds. As a first step to encouraging corporate membership the Executive Committee is proposing that the membership category of corporate member be split into levels based on corporate size. Corporate size will be defined by the number of employees. This will enable the corporate membership fee to be targeted to company size. Membership benefits will be the same for all corporate members.

The Executive Committee is also proposing to change the name of the category from corporate to industry since not all companies are corporations.

Current	Proposed
Article 4 Governments, Authorities and Members	**Article 4 Governments, Authorities and Members**
a) … g) ~~Corporate~~ Member A ~~Corporate~~ Member is any organisation which supports the Association and its objectives, pays an appropriate annual fee to the Association, and is admitted by the Association. (h) …	a) … g) Industry Member An Industry Member is any entity ~~organisation~~ which supports the Association and its objectives, pays an appropriate annual fee to the Association, and is admitted by the Association. The industry membership fee depends on the number of employees. (h) …

Electronic voting at the ISTA Ordinary General Meeting

Jonathan Taylor
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"Please raise your green cards."

These words, familiar to so many attendants at ISTA Ordinary Meetings, will now become a thing of the past. ISTA is moving to electronic voting.

Following approval by the ISTA Executive Committee, the Secretariat has purchased a PowerVote electronic voting system.

The most important feature of this system are the PowerVote voting keypads (see photo at right). Before the Ordinary General Meeting, each Voting Delegate will receive a voting keypad, which must be returned after the Meeting.

As usual, the various points of the agenda of the Meeting will be shown on the screen of the plenary room as PowerPoint slides. However, the computer showing the slides will have special voting slides within the PowerPoint presentation, and will be fitted with the PowerVote USB receiver.

Whenever a question requires a vote, the question will be shown on a voting slide, together with the possible voting options, for example:

1 = Yes
2 = No

The Voting Delegates can select their choice by pressing the relevant number. A wrong selection can be corrected by pressing the 'C' key.

The PowerVote keypad, with the number '1' selected

When the correct number is displayed on the keypad, the vote can be recorded by pressing 'OK'.

It is important that Voting Delegates check that they have entered the correct number for their vote, as the vote cannot be changed or withdrawn after 'OK' has been pressed.

The vote recorded is always for the question that is displayed on the screen at the time of voting.

After a suitable interval, the end of the voting is announced; the results can then be displayed on the screen, and saved to the computer as part of the PowerPoint file.

All the Voting Delegates then need to do is – please! – remember to hand in their keypads after the Meeting.

The new PowerVote system promises to speed up the voting procedure, and to allow reliable and fast recording of results at ISTA meetings. ■

EDINBURGH ISTA Annual Meeting 16-19 June 2014

Proposed changes to the *International Rules for Seed Testing* 2015 Edition

Jonathan Taylor
ISTA Publications Unit

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Again this year, a number of proposals for changes and amendments to the ISTA *International Rules for Seed Testing* will be submitted for voting by the nominated ISTA Designated Members on behalf of their respective Governments, under Agenda point 9. See also the Method Validation Reports on page 36, and on the ISTA web site at www.seedtest.org/OGM14.

Among the proposed changes are the following:

Chapter 1: Certificates
- Amendments to "Reporting results" following changes to 4.7

Chapter 2: Sampling
- Removal of text on evidence of heterogeneity (2.5.1.1)
- Clarification about suitable collecting containers: containers must be static free (2.4)

Chapter 3: The purity analysis
- Rounding of fractions clarified (3.6.1.3)
- Clarification regarding retention and storage of components until sample disposal (3.5.2, §4)

Chapter 4: Determination of other seeds by number
- Clarification how to report when seed cannot be identified with certainty to species level (4.7, following wording of 3.7)
- Clarification regarding retention and storage of seeds until sample disposal (4.5.2)

Chapter 5: The germination test
- More categories to describe seminal root defects (5.2.8.1)
- Allowing combinations of suitable growing media (5.4.1)
- Clarifying procedures for acceptance testing of media (5.4.3.2, 5.4.3.3)
- Clarifying procedures for counting errors during the germination test (5.6.1)

Chapter 6: Topographical tetrazolium test
- Additional information for the preparation and storage of tetrazolium solutions (6.4.1, 6.4.2)

Chapter 7: Seed health testing
- Modifications to seed health methods 7-009 and 7-019a, after comments and review by the authors and the SHC
- New seed health method 7-030: Detection of *Acidovorax valerianellae* on *Valerianella locusta* (Corn salad)
- Revision of Table 7A to include full crop names and pathogen names with authorities

Chapter 9: Moisture determination
- Clarification of the method to be used for new species (9.0, 9.0.1)
- Review of requirements for moisture calibration samples (filling containers; 9.2.1.5.2)
- Changes to methods for cutting seeds (9.1.5.2, 9.1.5.5)
- Changes to methods for cutting large tree seeds for moisture testing (9.1.5.5)

Chapter 10: Weight determination
- Coefficient of 6.0 should apply to all chaffy seed (10.5.3)
- Correct number of decimal places specified when weighing (10.6)

Chapter 11: Testing coated seeds
- Clarifying suitable media (11.5.4)

Chapter 15: Seed vigour testing
- Conductivity test for *Cicer arietinum* (15.8.1.2)
- Radicle emergence test for *Brassica napus* (15.8.4)
- Revision of 'General directions' text (15.5.2)

Chapter 19: Testing for seeds of genetically modified organisms
- Text change to better reflect the aims of the Chapter (19.4.1)

2014 11th Conference ISSS

Seed Science Conference 2014

15-19 September 2014
Changsha
China

The 11th Conference of the International Society for Seed Science (ISSS)

Seed science plays an increasingly important role in ensuring future food security in a sustainable environment and is therefore a subject of expanding international interest.

This 11th ISSS conference will build upon the success of previous conferences to bring together international experts and young scientists from around the world with an interest in the field of seed science.

The conference aims to provide a forum for the exchange of information and ideas on seed science and the development of new scientific collaborations. It will encompass the latest research progress in key areas of seed science including: seed development, dormancy, germination, stress tolerance, germplasm preservation, seed ecology, seed engineering and biotechnology to improve seed quality and hybrid seed.

Details of the programme, registration, venue and accommodation will appear on the website **http://2014seed.doevent.com** as the event draws closer. Please send your name and e-mail address to **seedscience2014@hhrrc.ac.cn** if you would like to be added to our mailing list and receive notification of the web site launch.

isss
international society for seed science

HHRRC CNHHRRDC

OECD Scheme for the Certification of Forest Reproductive Material: Annual Meeting in Paris

Fabio Gorian[1] and Dale Simpson[2]

[1]Chair and [2]Member, ISTA Forest Tree and Shrub Seed Committee

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Since 2007, the Annual Meeting of the OECD Scheme for the Certification of Forest Reproductive Material (FRM) has been held once a year, usually in Paris at the OECD headquarters. The goal of the Scheme is to encourage the worldwide trade of FRM. There are currently 25 member countries. Uganda and Kenya's applications for membership were approved at the 2014 meeting. The Annual Meeting is attended by representatives from member countries as well as by observers from other countries and international organizations, such as the FAO and ISTA.

The OECD Forest Scheme also comprises Technical Working Group (TWG), which meets twice a year, with the second meeting associated with the Annual Meeting. Recently, the TWG approved the inclusion of tested material within the Scheme, making the Scheme equivalent with the European Union's Directive 1999/105/CE.

At the last meeting, held in September 2013, many items were discussed, including the creation of a homogenous list of scientific species names, the inclusion of new definitions on forestry, agroforestry etc, into the rules of the Scheme, and the use of the Scheme for multifunctional forest trees. The FAO reported on the state of the world's forest genetic resources (FGR) and about the global plan of action on FGR. It was also stated that closer working relations with other international organizations will be necessary to enhance FRM quality along the supply chain. Delegations discussed establishing an international seed herbarium or photographic catalogue of forest tree seeds, and recommended that the TWG explore the possibility to use existing herbaria as reference material in the Scheme.

The 2013 Annual Meeting was chaired by ISTA Member Robert Karrfalt. Another ISTA Member, Dale Simpson, gave a comprehensive overview on the Canadian FRM certification system. In 2013, the OECD published the *OECD Guidelines on the Production of Forest Reproductive Materials* in English and French, written by another ISTA member, Fabio Gorian.

As you can see, ISTA Members are really active members in the OECD Forest Scheme!

The next Annual Meeting will be held in Paris on 24, 25 September 2014. ■

OECD Scheme for the Certification of Forest Reproductive Material: background

(from the OECD web site: www.oecd.org/agriculture/code/forestreproductivematerial.htm)

The OECD Scheme for the Control of Forest Reproductive Material Moving in International Trade is open to OECD Members as well as to other States. To date 25 participating countries implement the Scheme (including tropical countries which are developing their seed exchange for reforestation purposes). Seeds and plants are produced and officially controlled according to common harmonised procedures.

The OECD Forest Seed and Plant Scheme defines three broad categories of forest reproductive material recognised for certification: Source-identified material (minimum standard); Material from selected stands located in well-delimited regions of provenance; Material from untested seed orchards which can produce seed of improved quality.

Different OECD labels are used according to the category of the forest reproductive material. The labelled material is then recognised internationally as "QUALITY GUARANTEED" and "OF CONTROLLED ORIGIN". All categories included, the participating countries approved to date 275 tree species eligible for OECD certification of reproductive material, with a total area of 13.6 millions of hectares.

AN UPDATE OF THE RULES became necessary in recent years because of a growing commercial importance of new types of material derived from breeding programmes. A complete revision of the Scheme has been undertaken by participating countries to keep in line with new forestry production and tree improvement techniques. ■

ISTA Technical Committees: Working Programmes 2013–2016

Based on the ISTA Strategy, which was approved by the Members at the Congress 2013 in Turkey, the ISTA Technical Committees developed their working programmes. The working programme is prepared by each committee by evaluating the current situation in the Committee-related area worldwide, taking into account the resources available.

The working programme is established for a period of three years. Major changes are made in consultation with the Executive Committee and documented in annual progress reports.

This article highlights the main tasks and goals of each Technical Committee for this triennium.

Advanced Technology Committee

The ISTA Advanced Technology Committee (ATC) is committed to signal, evaluate and if appropriate introduce technologies new for ISTA into the Association. For this triennium ATC will report on, among others, application of multispectral imaging, chlorophyll fluorescence seed evaluation and X-ray seed imaging. ATC will organise ISTA (advanced) seminars on various topics, including seed image analysis. ATC searches for seed applicable technologies and proposes further studies of these.

Bulking and Sampling Committee

The Bulking and Sampling Committee will be very active during this triennium, especially as far as workshops and training is concerned. In 2014 alone we will present three Workshops on Seed Sampling and Quality Assurance in Sampling in Edinburgh, Scotland, Saskatoon, Canada and Bangalore India, with two more in the planning stage for 2015 in Uruguay and South Africa. In addition we will present a Sampling Seminar in conjunction with the 2014 ISTA Annual Meeting. However, our first priority is the finalization of the revision and the publication of the ISTA Handbook on Seed Sampling early in 2014. As far as Rules developments and special projects are concerned we will be working on sampling methods for seed health testing, seed mixtures, and seed lots contaminated by seed of parasitic plants (*Orobanche* and *Striga*). The minimum size of submitted samples, diameters of sampling probes and divider channels will also receive attention. We also plan to draw up a check list / SOP for sampling workshops and publish a guide on supporting material for 'Train the trainers'.

Editorial Board of Seed Science and Technology

The task of the Editorial Board is to edit the ISTA scientific journal 'Seed Science and Technology'.

Seed Science and Technology (SST) is one of the leading international journals featuring original papers and review articles in all areas of seed quality and physiology as related to seed production, harvest, processing, sampling, storage, genetic conservation, habitat regeneration, distribution and testing.

SST is published in three issues per volume and year with approximately 600 pages.

Flower Seed Testing Committee

More than 350 flower species are listed in the ISTA Rules, together with spice, herb and medicinal species. They belong to 192 genera and 55 families, and they are the focus of the activities of the ISTA Flower Seed Testing Committee (FSC).

In 2008 the first edition of the ISTA Handbook on Flower Seed Testing was published, and since that time the most important work of FSC is to publish new method sheets with the final aim to clarify laboratory seed testing methods listed in the ISTA Rules for the flower species. For the triennium 2013–2016, around forty new sheets will be prepared. Among them, for the first time, sheets dedicated to herbs and medicinal species will be included (e.g. *Hyssopus, Lavandula, Marrubium, Matricaria, Melissa, Mentha, Perilla, Pimpinella, Reseda, Ruta, Thymus, Sylibum, Valeriana*).

In the current working programme, the FSC has also planned validation studies by means of inter-laboratory comparative tests addressed to the inclusion of new species in the ISTA Rules (*Felicia heterophylla, Eustoma* spp.). Another part of the programme involves the revision of the sample sizes for the flower species, and in that framework the FSC is collecting data and information.

The FSC also collaborates with the Proficiency Test Committee in the preparation every three years of a special round for a flower species, and in 2014 we will have a Proficiency Test on *Callistephus chinensis*.

A new special project is also starting concerning wild flower species, becoming more and more popular, both for ornamental and environmental use.

In general, the FSC would like to represent the main reference for all stakeholders interested in flower seed testing, to provide analysts with practical information useful in their daily work and to help ISTA laboratories willing to include flowers in their scope of ISTA accreditation.

If you are interested in flower seed testing, or if you have proposals or useful information, please don't hesitate to contact the FSC!

Forest Tree and Shrub Seed Committee

The Forest Tree and Shrub Seed Committee has organized its programme for the next triennium, setting up 11 technical working groups. One goal is to develop each year protocols for two species, for both the tetrazolium and germination

tests. Another is to test water as a new substrate for *Populus* spp., and the use of agar, also as a new substrate. Finally, for the first time, a proficiency test will be organized with a broadleaf (*Fagus sylvatica*).

Germination Committee

An important task of the Germination Committee consists of developing new methods (germination duration for some grass or fodder species, treatments for breaking physiological or physical seed dormancy, new substrates for germination) or introducing methods for germinating new species (e.g. *Cleome gynandra, Chenopodium quinoa, Carica papaya, Salvia hispanica*). Many validation studies are thus carried out. These studies are conducted in close collaboration with the Flower Seed Committee and the Forest Tree and Shrub Committee. Another objective of the Committee is to improve the ISTA Handbook on Seedling Evaluation on specific parts such as sampling, substrates, light and seedling evaluation of specific species. Special projects are also planned for the next three years in order to harmonize germination methods between ISTA and AOSA, to study the interest of using in-house methods, to study new methods in collaboration with the Advanced Technology Committee and to start preparing E-learning documents for germination training of seed analysts.

GMO Committee

The GMO Technical Committee has a busy program planned in several key areas over the next three years. To facilitate this, the committee has established workgroups to share this work.

The GMO Proficiency Test Administration and Sample Preparation group will focus on execution of the GMO PTs by coordinating administration of the PT program with the ISTA Secretariat. This will include developing PT plans, evaluating results and ratings, addressing technical questions, and reviewing and updating the associated SOPs for administration of the GMO PT program and sample preparation. A significant success here has been recruitment of a new sample preparation laboratory, which will start preparing samples this year (2014).

Closely linked to this work, the GMO Proficiency Test Resource Procurement group will work to secure the reference materials (GM and non-GM) needed for the PT, as well as securing financial support for the program. Already, this group has secured funding and reference material for 2014.

The Workshops group will continue to develop training materials and deliver international training workshops in GMO testing in the coming years, and the ISTA GMO Web Site group will be developing content for the GMO TCOM web page.

The Statistical Tools for GMO Testing group will focus on proving specialized statistical support of the Committee, through projects such as the detection of stacked genes, GMO PT rating system evaluation; measurement uncertainty. Already, progress has been made by providing improved purity testing requirements for the GMO PT and performance data preparation for laboratories seeking accreditation for GMO testing which are significantly less burdensome, while still maintaining high quality.

The Publications group will coordinate writing of articles for journals such as STI, including results of the ISTA GMO PT program and reports of the GMO PT rounds.

Finally, the Rules-Handbook group will work to complete a high priority project: the Technical Handbook for GMO Testing. This handbook will support the new Rules chapter and provide guidance to those involved in GMO testing and accreditation by providing background on GMO testing, describing analytical approaches, and providing statistical tools, workbooks, and guidance on validation, QA, and becoming accredited by ISTA.

Moisture Committee

The Moisture Committee (MOI) working programme will over the next three years focus on finalizing the former triennium working programme and then on a validation study for small-seeded clover species, testing the need for grinding. Further, the MOI will work on the development of Rules change proposals for measuring water activity. This method is a non-destructive method, and therefore it will of interest for many laboratories working with small amounts of seed or with very costly seeds. A working group will also look at the possibilities for shortening the drying period for soybean.

Nomenclature Committee

The Nomenclature Committee has just completed a new (6th) edition of the *ISTA List of Stabilized Plant Names* in 2013. The last three editions of this publication reflect a 6-year cycle of revision, although opinions have been expressed to the Committee that more frequent updating of this document is desirable. The *Stabilized List* now treats approximately 3000 scientific names, and a complete evaluation of these requires considerable work by Committee members to identify potential taxonomic or nomenclatural changes and fully consider their adoption. Due to the size of this workload, the revision cycle cannot easily be shortened. To help overcome this obstacle, the Committee will be proposing to the ISTA Membership at the 2014 Annual Meeting to limit future editions of the *Stabilized List* to only the species (approx. 1000) listed in Table 2A, Parts 1–3 of the ISTA Rules. For the names of other species (approx. 2000) currently treated in the *Stabilized List*, the nomenclature reflected in the GRIN database would be endorsed by ISTA. If this proposal is approved, the workload for each subsequent revision of the *Stabilized List* would become more manageable, thereby permitting the Committee to revise this document more frequently and allowing ISTA nomenclature to become more responsive to global taxonomic or nomenclatural changes.

Proficiency Test Committee

At the ISTA Congress in Antalya, the Proficiency Test Committee decided to organize 11 test rounds in the triennium 2014–2016. In a triennium, every crop group must be covered by at least one proficiency test round. Besides, the Proficiency Test Programme plan should be balanced. This means that crops from all parts of the globe should be considered.

Purity analysis, germination testing and determination of other seeds are the standard tests. Some proficiency test rounds deal with viability testing, determination of moisture content and reporting results on

ISTA Certificates. These additional tests and the reporting must be offered at least once a year.

In close cooperation with the Vigour Committee, a conductivity test on pea seed was organized for 2014.

Very expressive are the activities of the Forest and Shrub Seed Committee to organize a second forest seed proficiency test round in 2015 on *Fagus sylvatica*. The participants will have to perform germination testing, viability testing and moisture determination. The results of one lot will have to be reported on an Orange International Seed Lot Certificate.

In order to include the crops of the southern hemisphere, *Oryza sativa*, *Glycine max* and *Brachiaria brizantha* were incorporated into the plan.

The purity analysis performed using seed blowers will be offered in a test round on seeds of *Poa pratensis*.

Identification of foreign seeds is not easy for inexperienced participants and is often the reason for poor ratings. The Proficiency Test Committee plans therefore to organize one voluntary training test round on seed identification every year. Participants will need to identify roughly 20 species in a seed mixture.

ISTA also offers proficiency test rounds on GMO and seed health testing, which are organized by the relevant Technical Committees.

Purity Committee

The Purity Committee welcomes new members Karima Boudehri and Dot Vittrup Pedersen for the next triennial term. The working programme will continue to review the Pure Seed Definition requirements for new species, and we would appreciate seed and/or data on the species listed in the working programme to be able to review the thousand-seed weight and therefore the working sample weights needed.

Proposals for Rules changes are often the outcome of questions to the Purity Committee, which highlight where improvements are needed mainly because the wording in the Rules is not clear and the interpretation is ambiguous. There are currently ten topics under 'Rules Changes' in the working programme, three of which have Rules proposals for voting in June 2014.

For publications, the Purity Committee has two working groups who are making steady progress with seed images and descriptions for the Universal List and the Handbook on Tropical Species. There is a standardized image format, and some excellent images are being prepared, which it is hoped will be available as digital images on the ISTA web site.

The Purity Committee intends to continue with the work on comparison of master calibration samples and their use and distribution to ISTA laboratories. The 'Guidelines for blower calibration and use of the uniform blowing procedure for *Poa pratensis* and *Dactylis glomerata*' will be updated to include the use of anemometers to measure the equivalent air velocity (EVA) which became effective from 1 January 2014.

There are special project areas such as 'toolkits for purity calculations' and 'new technologies' that the Committee hope to develop further to benefit the application of the ISTA Rules in purity testing.

The Purity Committee are looking forward to a busy and fruitful time.

Rules Committee

The Rules Committee 2013–2016 has some new members. The Rules Committee is composed of the Honorary President (Attilio Lovato, *ex-officio*) and the Chairs of the Technical Committees and the Editorial Board. As part of harmonization with AOSA, the Rules Committee Chairs of AOSA (Mr. Michael Stahr) and the SCST (Ms. Susan Alvarez) are now also *ex-officio* members of the ISTA Rules Committee. The ISTA Rules Chair is also an *ex-officio* member of the AOSA Rules Committee.

In January 2014, the International Rules for Seed Testing (ISTA Rules) were available for the first time as electronic versions to all members. With the move to the electronic version the ISTA Rules are no longer available in hard copy, but the electronic version which contains the English, French and German versions of the Rules is printable. It is worth remembering that if there is any doubt about the interpretation of the ISTA Rules the English version is the official reference version.

How did this work for you as an ISTA member? Do you like the electronic version? Or are there some things in the electronic version that can be improved?

Feedback on this and any other improvements to the content to the ISTA Rules can be sent to the Chair of the ISTA Rules Committee, Steve Jones, or to the Chair of the relevant Technical Committee.

In June 2014 in Edinburgh the ISTA Membership will be discussing, and then the designated voting members of ISTA will be voting on, the proposals for changes to the ISTA Rules to become effective in January 2015. This year, the topics for discussion and approval include, for example: changes to the number of species in the ISTA Stabilized List, clarifications and improvements to text in the Rules, proposals for sampling, purity testing, other seed determinations, germination, tetrazolium, moisture, weight determination, coated seed and GMO chapters. In addition, there are new and modified seed health methods and new species to be included in the vigour testing chapter. For the full proposals and the associated validation reports see the Ordinary General Meeting documents on the ISTA web site at:

www.seedtest.org/OGM14

Seed Health Committee

The Seed Health Committee (SHC) is involved in the European project TESTA and the update of the ISTA annotated list of seed-borne diseases, and discussions have begun with ISF to collaborate with them on the list of pathogens, in order to arrive at a unique list to be published. For TESTA, members of the SHC are also working on the validation of methods for detection of pathogens.

Nine method validation projects are in progress, including three methods to be voted on next June, two from ISHI-Veg and one coming from an Euphresco/EPPO project. Each seed health method is reviewed every five years through a questionnaire sent to ISTA Members and contacts. Reports are published in STI, and actions are prioritized when modifications of methods are necessary. As a consequence of this review, the harmonization of names

of methods and of taxonomic names of pathogens has been proposed for a vote.

Two workshops are being organized in 2014 on seed health, one in Poland in September and one in Indonesia in November. Details for registration can be found on the ISTA web site.

SHC continues its collaboration with the Statistics Committee to set up guidelines for the organization and statistical analysis of proficiency tests and of method validation, and the first guidelines were published on the ISTA web site in 2013.

Statistics Committee

The aim of the Statistics Committee is to provide statistical support to ISTA. For 2013–2016, we will continue to provide this statistical expertise for the different ISTA Technical Committees. We will also work on more specific projects; without providing an exhaustive list, here are some projects we plan to work on for this triennium:

- Delivering a new version of Seedcalc for MS Excel 2007.
- Delivering a tool for the analysis of ISTA germination validation studies.
- Revising the rating methodology of the ISTA GMO Proficiency Tests (PTs).
- Developing methodology and tools for the rating of SH PTs.
- Assessing seed purity requirements for elaborating ISTA GMO PTs samples.
- Developing methods for appropriate probability computations for small seed lots.

One area we believe is promising in Statistics for seed testing is Bayesian Statistics and we are planning to explore this area in the future. Finally, be aware that we are available to give workshops on statistics in seed testing.

Storage Committee

The Storage Committee is planning to publish 30 new publications within this triennium. One big goal for the Committee is the new Handbook on Seed Storage, which will include an appendix on seed storage of Rules species. Furthermore, the committee is working on various special projects, such as the characterisation of seed storage characteristics of 100 'new' species, the development and/or application of five innovations or techniques associated with seed storage (e.g. cathodic amelioration, lipid biophysical analysis) and the maximisation of dry storage potential (including seed health) for seeds of 70 species.

Tetrazolium Committee

In May 2012, the Committee began a storage experiment. We wanted to know how long the prepared tetrazolium solution is storable under optimum conditions (cold and in a brown bottle in darkness). In May 2014, we had the result: up to one year without any reduction of efficacy. On this basis we presented a rules proposal for voting at the 2014 Ordinary General Meeting. More information about the experiment is on the web site.

We plan to introduce a method for *Glycine max* into the ISTA Rules. We hope to finalize this project this year. At the moment we are at the stage before shipping the seeds to the participants.

For *Pennisetum*, *Larix* and *Pinus* we made no progress.

The revision of the working sheets is in progress and should be ready at the end of this year.

The reorganization of a new Tetrazolium Handbook is also still in progress, but a precise date of finalization is not foreseeable yet.

Variety Committee

The Variety Committee has representatives from twelve countries and three continents. The proposed Rules developments for the next triennium include the development of a semi-performance-based approach for DNA-based tests, the introduction of new species such as *Sorghum*, *Poa*, *Agrostis* and tomato, and the introduction of new tests such as DNA-based methods. The Variety Committee is also working on new publications such as the revision of Handbooks, including the introduction of the DNA Handbook and the collection of methods. We are also working on the organization of workshops, such as those in Canada and India, and proficiency tests for several techniques.

Vigour Committee

In 2013–2016, the work of the Vigour Committee that relates directly to the ISTA Rules will focus on the current validated vigour tests, in particular, extending the scope of the radicle emergence and conductivity tests and shortening the controlled deterioration test.

Work on the radicle emergence test will focus on a wide range of species, including vegetables (leek, cabbage, onion,), grasses (*Lolium perenne, Elymus nutans, Festuca arundinacea*) and field crops (soybean, wheat, alfalfa, sunflower). Initial work will determine suitable conditions and timing for obtaining a count of radicle emergence before test results are compared to emergence and/or storage trials. Following this background development work, small-scale comparative tests, to determine whether the test protocols are repeatable and reproducible, will be followed by comparative tests that will form part of method validation.

Extension of the scope of the conductivity test will be limited to the small-seeded, coloured Desi-type chickpea (*Cicer arietinum*). In this case, the validated conductivity test in the ISTA Rules will be applied and the result compared to the results of field emergence trials.

Two approaches to shortening the controlled deterioration test will also be examined. One of these is an alternative method for raising seed moisture content, the second the use of a conductivity measurement as an alternative to the germination test that is currently performed after the deterioration step of the test. These alternative procedures would reduce the test time to three days compared to the current 10–14 days.

In addition to work related to the ISTA Rules, research projects will be ongoing, including investigations on the application of the controlled deterioration test to tomato, the cell cycle in high and low vigour maize, controlled deterioration and storage potential in canola (*Brassica napus*), and comparisons of vigour test methods in canola. A proficiency test on conductivity for *Pisum sativum* will take place in early 2014, and in November 2014 a workshop will be held in Bengaluru, India. ■

New faces at the ISTA Secretariat

Sejal Patel

Administrator

Sejal Patel was born in Africa (Kenya), before moving to London in 1980. She graduated with a BSc degree with Honours in Computing with Business from the University of Hertfordshire, UK.

After graduating, she worked in various industries and corporations of various sizes, where she held a variety of roles in the areas of marketing, telecommunications, customer support and IT consultancy in the UK, before moving to Switzerland in 2000, where she carried on working for the IT and telecommunications industry before deciding to have a break from her professional career to have a family. Sejal is married and has two children, and is a certified health and wellness coach. During this time she worked as a playgroup leader and volunteered at a local charitable foundation which runs a garden nursery and home for children with learning difficulties, providing the carers with IT-related training.

Sejal joined the ISTA Secretariat as an Administrator (part-time) in November 2013, working with the Administration Department in helping with the Annual Meeting preparations and with the Accreditation and Technical Department with audit preparations, proficiency tests and certificate orders. ■

Olga Stöckli

Administrator

Olga Stoeckli was born in Moscow and studied at the Moscow Communication and Informatics University, which trains students in economics and managing IT and telecommunication enterprises in the areas of organizational management, planning and analysis, finance, economics, scientific research, design and marketing activities and solving practical problems of market economics. In 2002 she obtained a Master's Degree as Manager Economist.

From 2002, Olga Stoeckli worked in various positions at the Russian Post, which operates 86 large hubs and 42 000 branches with 415 000 employees throughout the Russian Federation. Olga was first assisting financial audits and then worked as a Key Account Manager in the Moscow Region for 27 branches. In a third phase as a Senior Specialist in the Treasury/Cash Operations & Development department, she deployed regional treasury in all 86 Russian large postal hubs throughout the Russian Federation.

From 2007, Olga worked as a Project Manager in the Quality Department of the Business Unit "Foreign Subsidiaries" in Mobile Telesystems (MTS) and became a certified Chief Auditor ISO-9001 during this time. MTS is the leading telecommunications group in Russia, Eastern Europe and Central Asia, serving over 100 million mobile subscribers in Russia, the Ukraine, Uzbekistan, Turkmenistan, Armenia and Belarus, a region that has a total population of more than 230 million. Her main tasks were implementing the group quality strategy, tracking it with statistics monitoring, challenging each country's quality performance in both technical and customer service areas and performing business process auditing in central and decentral business unit bodies.

Olga Stoeckli joined the ISTA Secretariat as an Administrator (part-time) in February 2014, working with the Administration Department on pressing ongoing affairs, currently mainly the upcoming ISTA Annual Meeting in Edinburgh and membership administration. ■

ISTA Annual Meeting 2014, Edinburgh, UK, 16–19 June 2014
Online registration: www.seedtest.org/AM14

Update on the electronic Rules 2014

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At the beginning of January, the International Rules for Seed Testing were published for the first time in a completely electronic edition.

Many ISTA Members were familiar with the use of this format, since online subscriptions to ISTA's journal *Seed Science and Technology* had already been available for several years. Most users thus had no problems in registering accounts on the Ingentaconnect web site and requesting access. At the Secretariat, we were kept busy verifying subscription requests, not only for the Rules, but also for SST.

Personal or institutional account?

However, for others it was a novelty which needed getting used to. A few representatives of Member Laboratories registered personal accounts instead of institutional accounts. This meant that they could not request institutional subscriptions with multiple-user access. It is recommended that Member Laboratories register with institutional accounts and an account administrator, who can then organize subscriptions for the whole laboratory.

Problems with PDF readers

Some users who had downloaded the Rules with the Mozilla Firefox web browser discovered that, other than announced, the texts of all three language appeared at the same time, and none could be switched off.

This problem was traced to the built-in Firefox PDF reader, which needs to be disabled.

It is also advised not to save any PDF file of the electronic Rules using PDF editing software other than Adobe Acrobat Reader, which is recommended and can be downloaded free of charge from www.adobe.com.

Copying the Rules PDF files?

We received a few enquiries about whether it was allowed to make copies of the Rules PDF files for others to use. This concerned especially the single-user access for Personal and Associate Members and purchasers of single downloads.

According to the ISTA Copyright Policy, electronic copies of ISTA works are not permitted, except for backup purposes.

However, it is acceptable for a backup copy on another device to be used also, as long as only one copy of a downloaded PDF file is used at any one time.

The principle to be followed is that when two PDF copies are used at the same time by different users, there needs to be two purchases or memberships. ■

Doctorate for ISTA Statistics Committee Chair Jean-Louis Laffont

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We would like to offer very hearty congratulations to Dr. Jean-Louis Laffont, a valued ISTA colleague, on his recent completion of a Doctor of Philosophy Degree in Mathematics and Statistics from ONIRIS, the Nantes Atlantic College of Veterinary Medicine, Food Science and Engineering, Nantes, France. His dissertation research focused on modeling genotype by environment interactions in plant breeding using a novel biplot and two-way analysis approach. We are all beneficiaries of Jean-Louis's numerous contributions to our Association as he has served as Chair of the ISTA Statistics Committee and active member of the ISTA GMO Committee. He has added much statistical rigor to ISTA study designs, data analysis and seed testing rules from advances in statistical theory in recent years. Many have benefited from participating in workshops that Jean-Louis instructed in areas including GMO testing, germination and seed health. Jean-Louis has been instrumental in bringing many new software program tools to the hands of seed testing scientists including the germination calculator and

enhancements to SeedCalc. Again we congratulate Jean-Louis for this great accomplishment and hope for many more years of associating with him in ISTA. ■

DOIs Я Us: digital object identifiers for *Seed Science and Technology* papers

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ISTA is taking a further step forward in the field of electronic publishing.

Beginning with the April 2014 issue, all papers published in ISTA's scientific journal *Seed Science and Technology* (SST) will be given a **digital object identifier**, or **DOI name**.

The problem: changing URLs

For readers who may be unfamiliar with this subject, the DOI system and DOI names address a common problem with locating digital objects on the Internet.

As is well known to most users of the Internet, digital objects comprise all kinds of digital files to be found on the Internet: web pages, PDF files of all kinds of documents, photographs, sound files etc. At any one time, all of these objects can be identified and located by their **uniform resource locator**, or **URL**, also known as **web address**. The object can be opened in a web browser or other program by a hyperlink containing the URL, or by entering the URL directly in the address field of the browser.

Since an object is identified by its URL, the URL can be published by others at other locations on the Internet (e.g. in reference lists), thus acting as both a reference and a direct link to the digital object.

However, if a URL of an object is changed, either by renaming files or folders or by moving the object to a different location, these references and links in other locations will become outdated and will cease to function (dead links), since they are outside the control of the original publisher.

The solution: DOI names

This problem is solved by the DOI system and DOI names.

In principle, the DOI system consists of a database or registry, in which each digital object is given an unambiguous, unique and permanent DOI name, which is associated with metadata of the object, including its URL.

After a digital object has been published online, it must be registered with the DOI system, when it must be given a DOI name, and when its metadata must be entered, including its URL.

If the URL of a digital object is changed, the publisher only needs to update its metadata in the DOI system. The DOI name itself, once issued, is never changed, and hence can serve as a permanent reference to the object, as long as the publisher maintains the entry in the DOI system.

DOI names in practice

The DOI name itself consists of a prefix, which identifies the publisher, a forward slash, and a suffix, which identifies the object. The suffix is determined by the publisher, and can be completely random (as long as it is unique), or can follow some kind of system. Thus, a typical DOI name for a paper in Seed Science and Technology might look like this:

10.15258/sst.2013.41.3.01

A DOI name of a paper can be converted into a web address by adding in front the URL of the DOI web site, like this:

http://doi.org/10.15258/sst.2013.41.3.01

In this form, it can be added to the bibliographic reference of this paper, when cited in another paper. On a web page or in a PDF document, it will become a direct hyperlink, in this case to the abstract page of this SST paper on the Ingentaconnect web site.

DOI names for SST papers

Beginning with the April 2014 issue, all papers published in SST will be given a DOI name, which will appear on the first page of each paper in both the online and print editions.

Older papers from 2003 to 2013, which are already available online, will also be registered and given DOI names, but the existing PDF files will not be amended to include the DOI names. However, a list of these papers will be published on the ISTA web site, allowing authors to add DOI names to citations of SST papers.

Further information

The first stop for information on the DOI system must be the web site of the International DOI Foundation:

http://www.doi.org

Publishers wishing to use DOI names for their publications must become a member of a registration agency. ISTA has become a member of The Publishers International Linking Association Inc. (PILA), which does business under the name CrossRef:

http://www.crossref.org

There are Wikipedia articles on DOIs in a number of languages:

http://en.wikipedia.org/wiki/Digital_object_identifier

ISTA membership changes

Status 17 March 2014

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Method validation reports on Rules proposals for the ISTA Rules 2015 Edition

Full texts on the ISTA web site at www.seedtest.org/OGM14

Modification to existing seed health method. 7-009: Detection of *Gibberella circinata* on *Pinus* spp. (pine) and *Pseudotsuga menziesii* (Douglas-fir) seed

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Background

Gibberella circinata is the causal agent of pitch canker disease. The disease almost exclusively affects *Pinus* spp., but was also described on Douglas-fir (*Pseudotsuga menziesii*). This disease is a serious threat to the pine forests wherever it occurs (especially on plantations of *Pinus radiata*), due to extensive tree mortality, reduced growth and timber quality. Conifer seeds can be colonized by *G. circinata* internally (where it can remain dormant until seed germination) and externally (Storer *et al*., 1998).

Although an official ISTA method was published in 2002 to detect *F. moniliforme* f. sp. *subglutinans* in seeds of *Pinus taeda* and *Pinus elliotii* (ISTA, 2002), the morphological features indicated as typical for *F. moniliforme* f. sp. *subglutinans* in this method were based on a substrate not showing the characteristic sterile hyphae of this pathogen and were not sufficient to ensure a reliable identification of *F. circinatum* Nirenberg & O'Donnell (anamorphic stage of *G. circinata*). This method and the accompanying figures are taken from the EPPO diagnostic protocol PM 7/91 (EPPO, 2009). This method has been evaluated through a European ring test (Ioos *et al.*, 2013). This method is very efficient and reliable to isolate any *Fusarium* spp. from infected seeds and does not require expensive equipment. However, the correct morphological identification of *F. circinatum* in pure culture requires experience and a molecular confirmation should be carried out in case of uncertainty, such as those described in EPPO (2009) and in Ioos *et al.* (2013). In addition, Storer *et al.* (1998) have demonstrated that agar plating of pine seeds may not be able to detect dormant (quiescent) propagules of *F. circinatum*, thus leading to an unknown risk of false negative results.

This protocol replaces the former ISTA procotol "7-009: Detection of *Fusarium moniliforme* var. *subglutinans* on *Pinus taeda* and *P. elliotii* (Pine)", which did not take into consideration the more recent taxonomic re-assignation of *Fusarium moniliforme* var. *subglutinans* to *F. circinatum*, anamorph of *Gibberella circinata* (Nirenberg and O'Donnell, 1998), and in particular the production of typical sterile hyphae by this species.

Validation studies

Test performance study of diagnostic procedures for identification and detection of *Gibberella circinata* in pine seeds was carried out in the framework of a EUPHRESCO project (Ioos *et al.* 2013).

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Proposal for replacement of mCS20ABN and FS media recipes in ISTA Rule 7-019a (*Xanthomonas campestris* pv. *campestris* detection in *Brassica* spp. seed lots) by adapted versions

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Summary

The recipes of the FS and mCS20ABN semi-selective media described in the ISTA Rule 7-019a were adapted to increase their performance regarding the recovery and recognition of *Xanthomonas campestris* pv. *campestris* (Xcc) on the plates as well as safety and practicality in their preparation. The adapted and ISTA Rule 7-019a media recipes were compared between five seed health testing laboratories in an ISHI-Veg peer validation study that was organized in parallel to the ISTA proficiency test. Extracts of three 10 000-seed subsamples of a low, medium, high and Xcc-free cabbage lot were plated on media plates prepared with the adapted and the ISTA Rule 7-019a recipes. Comparison of results showed no difference between the two recipes. The benefits of the adapted FS and mCS20ABN media recipes suggest the replacement of the ISTA Rule 7-019a recipes by the former.

Validation of a new method for the detection of *Acidovorax valerianellae* on corn salad (*Valerianella locusta*)

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Summary

The performance of an ISHI-Veg developed method for the detection of the seed-transmitted pathogen *Acidovorax valerianellae* (Av) on corn salad (*Valerianellae locusta*) seed was evaluated in an international comparative test between eight laboratories organized by ISHI-Veg. The method includes a grow-out test performed in a sweatbox followed by PCR confirmation of Av on symptomatic/doubtful corn salad cotyledons at 14 or 21 days after sowing. One pathogen-free untreated, and two (low and medium infected) naturally contaminated seed lots with variable saprophytic loads were compared. Each seed lot was tested in six blind replicates of 5000 seeds. One 1000-seed sample from the pathogen-free and one 1000 seed sample of the medium contaminated seed lot served as negative and positive control, respectively. In the same comparison a potting soil-vermiculite mixture showed comparable results to vermiculite alone as substrate and is therefore considered an alternative. No significant effect of Thiram treatment was shown on the saprophytic load of seed lots. Yet, its application in the recommended ratio can ensure discernible Av symptoms on corn salad cotyledons. The detection method showed high values of accordance (repeatability), concordance (reproducibility), sensitivity, specificity and accuracy for all three contamination levels. Therefore, it is considered to be a reliable method for the detection of Av on corn salad seed and is highly recommended in routine seed health testing.

Proposal for the addition of *Cicer arietinum* (Kabuli type) as a species to which the conductivity test for seed vigour can be applied

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Summary

Six seed lots of *Cicer arietinum* (Kabuli type), all having a laboratory germination of >80 %, were tested by three laboratories using the electrical conductivity test, as described in the ISTA Rules for *Pisum sativum* for 24 h in two runs in each laboratory. All laboratories consistently identified the same significant differences in the seed lot conductivity and the data was repeatable within laboratories and reproducible between laboratories. This provides evidence in support of the addition of *Cicer arietinum* (Kabuli type), to the ISTA Rules as a species for which the conductivity test can be applied.

Introduction

The conductivity test is validated in the ISTA Rules as a test that can be applied to species of *Pisum sativum* (garden pea only, excluding petit-pois varieties), *Phaseolus vulgaris* and *Glycine max*. This test is based on the leakage of solutes that occurs from all seeds that are soaked in water. These solutes include sugars, amino acids and most importantly for the test, electrolytes. Thus the incidence of leakage can be detected by measurement of the electrical conductivity (EC) of the seed soak-water. The test was developed following the observation of the correlation between solute leakage and field emergence in wrinkled-seeded vining peas (*Pisum sativum*). Low leakage and therefore low conductivity was associated with seeds that emerged well, that is seeds with high vigour; whereas low vigour seeds with poor emergence had high levels of leakage and conductivity (Matthews and Whitbread, 1968). The conductivity test has also been used as an indicator of field emergence in field beans (*Vicia faba*, Hegarty, 1977), *Phaseolus* beans (Matthews and Bradnock, 1968; Powell *et al.*, 1986), soybean (Oliveria *et al.*, 1984; Yaklich *et al.*, 1984) and long bean (*Vigna sesquipedalis*; Abdullah *et al.*, 1991). Leakage has also been related to emergence in the light-coloured, larger seeded Kabuli type chickpea (*Cicer arietinum*) (Khajeh-Hosseini *et al.*, 2007; Khajeh-Hosseini and Rezazadeh, 2011). Investigations are currently in progress using the coloured, smaller-seeded Desi type (ISTA Vigour Committee, 2013–2016). The test identifies where solute leakage occurs as a result of decreased membrane integrity and the death of tissue during the ageing of seeds. The objective of this study was to demonstrate that the conductivity test applied to *Cicer arietinum* (Kabuli type), is both repeatable within laboratories and reproducible between laboratories.

Discussion

The conductivity test consistently identified differences between seed lots in each of three laboratories. The test was both repeatable within laboratories and reproducible in different laboratories. In addition, where the conductivity measurements of lots fell within the range of the tolerance tables (ISTA, 2013), the replicates within the laboratories and the mean values obtained for each lot in different laboratories were within tolerance. In three lots (A, D and F) seed vigour was particularly low, giving conductivity measurements higher than those in the tolerance tables. Nevertheless, application of the highest tolerance value from Tables 15B and D (ISTA, 2013) revealed that only in lot D, Run 1 were the replicate means out of tolerance, and only two out of six lab means (2 runs × 3 labs) were out of tolerance. This provides evidence in support of the addition of *Cicer arietinum* (Kabuli type), to the ISTA Rules as a species for which the conductivity test can be applied.

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Early counts of radicle emergence as a vigour test for oil seed rape

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Summary

Radicle emergence (RE) of nine seed lots of oilseed rape was assessed after 30 h at 20 °C by each of three laboratories. Clear and significant differences were observed between lots in all laboratories. All results were within tolerance and both repeatability and reproducibility were good, there being no evidence of over-dispersion. It is proposed that the RE test be validated as a vigour test for oilseed rape.

Introduction

Early counts of radicle emergence of maize (after 6 d at 13 °C or 66 h at 20 °C), have been shown to be closely related to the rate of germination, as expressed by the mean germination time (MGT) and to vigour, reflected in the rate of and final field emergence (Matthews *et al.*, 2011a,b). This resulted in the introduction of the radicle emergence (RE) vigour test for maize to the ISTA Rules in 2010. Similar highly significant relationships have been seen in several other crop species (Matthews and Powell, 2011). Recent work on oilseed rape (*Brassica napus*)(Matthews *et al.*, 2012) has shown that single counts of radicle emergence of oilseed rape, taken after 30 h at 20 °C are also indicative of the rate of germination and vigour. Thus, single counts of radicle emergence predicted the MGT (R^2 = 0.920), 7 day field emergence (R^2 = 0.961) and maximum field emergence (R^2 = 0.713). In addition, the results were highly consistent between three laboratories (Matthews *et al.* 2012). The aim of this report is to analyse the data from the three laboratories to illustrate the repeatability and reproducibility of the test method.

Discussion

The significant differences in the radicle emergence of seed lots, revealed here across three laboratories have previously been shown to predict both the rate of, and final, emergence of the lots in the field (Matthews *et al.* 2012) and therefore predict differences in seed vigour of the lots. The standard germination (%) was also significantly correlated with the rate of, and final, emergence. However, the difference between the lowest and highest standard germination was small, only 9 % when all lots were considered, and only 5 % different for eight of the nine lots. Clear differences in vigour between the lots would therefore not be identified. In contrast, the range of RE test results was from 51 to 95 %, clearly distinguishing differences between the lots. Thus, lots E and F were clearly identified as having higher vigour than lots I and H even though they all had the same standard germination, 98 % (Table 1). In addition the repeatability and reproducibility of the data supports the proposal that the radicle emergence test can be used routinely to reveal differences in seed vigour of oilseed rape.

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The Central Reference Laboratory (LCR) of the National Inspection Service for Seed Certification (SNICS) of Mexico has obtained international accreditation by the International Seed Testing Association, demonstrating technical competence and high reliability of results in seed testing.

After relocation, the Central Reference Laboratory took up operations again in 2008, to provide nationwide sampling and seed testing services. A Member of ISTA since 2003, the laboratory has pursued excellence and quality in seed testing to achieve international recognition through such ISTA international accreditation.

There was much that needed to be done to prepare for international accreditation. This process included:

– Participation in international proficiency tests for five consecutive years, achieving outstanding results, to the same level as accredited laboratories worldwide.
– Implementation of a quality management system, which set strict quality controls at all stages of the sampling and seed testing process, to ensure technical competence.
– Training: laboratory staff participated at international workshops to achieve the required level of qualifications.

This preparation took two years, in which the purchase of equipment, training,

establishment of quality control and improvement of the quality management system was completed. Finally, the ISTA accreditation audit was scheduled for 9 October 2013.

The ISTA audit was conducted at the LCR site by ISTA auditors, who issued a number of non-conformities and recommendations. These were all resolved promptly with corrective actions and approved by the auditors, who were thus able to recommend that accreditation should be granted.

The scope of the LCR's accreditation includes seed sampling, purity and identification of other seeds, identification of other seeds by number, germination and viability, and weight determination per 1000 seeds for oats, rice, barley, rye, corn, sorghum, wheat and triticale, allowing the laboratory to issue Orange International Seed Lot Certificates and Blue International Seed Sample Certificates for these crops.

Thus, from now on, the seed produced in Mexico under OECD certification schemes may be exported as certified seed, since Mexico is recognized by the OECD to implement monitoring methodologies in the field to describe the genetic quality, and the ISTA laboratory can issue certificates to rate the quality laboratory. The process of international seed certification system in Mexico is complete.

With this great achievement the Mexican seed sector has access to this area of opportunity, helping to develop the competitiveness of the rural economy of Mexico, and advance the institutional commitment to provide best-quality and modern services.

With this accreditation, the LCR joins the small group of accredited laboratories worldwide (numbering only 120) which may issue ISTA Certificates and becomes a laboratory recognized for its expertise and quality. The laboratory is the only internationally accredited laboratory in the entire Central American region, and one of only six laboratories in Latin America. ■

Laboratory accreditation changes

Status 17 March 2014

Re-accreditations

Canada CADL0400

Ontario Plant Laboratories
Plant Pathology Laboratory
Canadian Food Inspection Agency
Ottawa Laboratory Fallowfield
Ottawa, Ontario K2H 8P9
Phone: +1 613 7591292
Fax: +1 613 759 1260
E-mail: devernol@inspection.gc.ca

CADL0800

Canadian Food Inspection Agency, Saskatoon Laboratory
Seed Science & Technology Section
301-421 Downey Road
Saskatoon, Sask. S7N 4L8
Phone: +1 306 385 4854
Fax: +1 306 385 4944
E-mail: jmaruschak@inspection.gc.ca

Chile CLDL0200

Laboratorio Oficial de Análisis de Semillas
Servicio Agricola y Ganadero
Correo Central, Km.22, Ruta 68
Cas. 4088 Santiago
Phone: +56 2 345 1831
Fax: +56 2 345 1802
E-mail: laboratorio.semillas@sag.gob.cl

Denmark DKML0800

Maribo Seed International ApS
Germination Laboratory
Højbygårdvej 31
4960 Holeby
Phone: +45 5446 0734
Fax: +45 5446 0703
E-mail: morten.jorsboe@mariboseed.com

France FRML0700

Pioneer Génétique S.A.R.L.
Seed Quality Laboratory
1131 Chemin de l'Enseignure
31840 Aussonne
Phone: +33 5 61 06 20 00
Fax: +33 5 61 06 20 67
E-mail: hortense.faucher@pioneer.com

Germany DEDL1000

LUFA Speyer, Referat Saatgutprüfung
Obere Langgasse 40
67346 Speyer am Rhein
Phone: +49 623 21360
Fax: +49 6232136110
E-mail: seibert@lufa-speyer.de

Ireland IEDL0100

Seed Testing Laboratory, Department of Agriculture & Food, Backweston Campus
Youngs Cross, Celbridge
Co. Kildare
Phone: +353 1 615 7505
Fax: +353 1 615 7196
E-mail: johnjoe.byrne@agriculture.gov.ie

Korea (South) KRML0200

Seed Testing Laboratory, Ministry for Food, Agriculture, Forestry and Fisheries
Korea Seed and Variety Service
39 Taejangro, Yeongtong-gu, Gyeonggi-do
443-400 Suwon-si
Phone: +82 31 8008 0230
Fax: +82 31 203 7431
E-mail: eunhee.soh@korea.kr

Lithuania LTDL0100

Plant Products Quality Testing Laboratory (Division) of the State Plant Service under the Ministry of Agriculture
Ozo g. 4A
08200 Vilnius
Phone: +370 5 276 0341
Fax: +370 5 273 30233 and +370 5 237 5631
E-mail: arvydas.basiulis@vatzum.lt

Norway NODL0100

Kimen Seed Laboratory
P.O. Box 164
N-1431 Ås
Phone: +47 64 970665
Fax: +47 64 970663
E-mail: ht@kimen.no

Portugal PTDL0100

Direção-Geral de Alimentação e Veterinária
Direção de Serviços de Sanidade Vegetal
Divisão de Variedades e Sementes
Edificio II - Tapada da Ajuda
1349-018 Lisboa
Phone: +351 21 3613274
Fax: +351 213613277
E-mail: pcarvalho@dgadr.pt

Romania RODL0200

Forest Research and Management Institute (ICAS), Laboratorul de Seminte
B-ul Eroilor 128
077190 Voluntari, Bucuresti
Phone: +40 21 350 32 45
Fax: +40 21 350 32 45
E-mail: genetica@icas.ro

Russian Federation RUDL0100

Russian Agricultural Centre
Orlikov pereulok 1/11
107139 Moscow
Phone: +7 095 2077064
Fax: +7 095 2070567
E-mail: alexmalko@mail.ru

RUML0300

Federal State Budgetary Institution
Krasnodar Interregional Veterinary Laboratory
Kalinina st, 15
35004 Krasnodar
Phone: +7 861 226 2243
Fax: +7 861 226 2243
E-mail: kmvl_krasnodar@mail.ru

Separate Customs Territory of Taiwan, Penghu, Kinmen and Matsu TWDL0100

Seed Testing Laboratory, Council of Agriculture
76 Chung-Cheng Road
Wu Feng, Taichung
Phone: +886 4 23394371
Fax: +886 423335425
E-mail: tpst101@ms27.hinet.net

Spain ESDL0100

Estación de Ensayos INIA
Carretera de la Coruña, km 7,500
28040 Madrid
Phone: +34 91 347 4171
Fax: +34 91 3474168
E-mail: luismv@inia.es

Sweden SEDL0700

Frökontrollen Mellansverige AB, Section Örebro
P.O. Box 22014
702 02 Örebro
Phone: +46 19 6114607
Fax: +46 19 135082
E-mail: frokontrollen@hush.se

SEML0900

Syngenta Seeds AB, Quality Control Laboratory
P.O. Box 302
261 23 Landskrona
Phone: +46 418 437243
Fax: +46 418 437132
E-mail: cristel.lindberg@syngenta.com

United Kingdom GBDL0400

Official Seed Testing Station for Scotland
Science and Advice for Scottish Agriculture
1 Roddinglaw Road
Edinburgh EH12 9FJ
Phone: +44 131 244 8900
Fax: +44 131 244 8940
E-mail: valerie.cockerell@sasa.gsi.gov.uk

Uruguay UYDL0200

Instituto Nacional de Semillas (INASE)
Cam. Bertolotti s/n y, Ruta 8, Km 29
Barros Blancos, Canelones
Phone: +598 2 2887099
Fax: +598 2 2887077
E-mail: inase@inase.org.uy

Newly accredited

China CNDL0100

China Agricultural University
Forage Seed Laboratory
2 Yuangmingyuan West Road, HaiDian District
Beijing 100193
Phone: +86 10 62733311
Fax: +86 10 62733311
E-mail: maopeisheng@hotmail.com

Mexico MXDL0100

Servicio Nacional de Inspección y Certificación de Semillas (SNICS)
Av. Presidente Juárez no. 13
Col. El Cortijo
Tlalnepantla, 54000
Phone: +52 55 651910 or 53842213 Ext:21
Fax: +52 53 901441
E-mail: manuel.chavez@sagarpa.gob.mx

New Zealand NZML0500

Kimihia Research Centre Laboratory
PGG Wrightson Seeds Ltd
742 Tancreds Road, RD 6
7676 Lincoln, Christchurch
Phone: +64 3 325 3573
Fax: +64 3 325 2417
E-mail: jsutherland@pggwrightsonseeds.co.nz

ANNOUNCEMENT

ISTA Workshop on Seed Sampling and Quality Assurance in Seed Sampling

Edinburgh, United Kingdom, 23–26 June 2014

www.seedtest.org/bscws614

This Workshop is fully booked. See also Workshop on Seed Sampling and Quality Assurance in Seed Sampling in Bengaluru, India, 17–20 November 2014 (page 49)

ISTA Workshop on Variety Identification Using Molecular Markers

Ottawa, Canada, 7–10 July 2014

www.seedtest.org/varws714

Organizer

Canadian Food Inspection Agency (CFIA)
Ottawa Plant Laboratories
Ottawa, Ontario, Canada, K2H 8P9
Contact: Marie-José Côté
E-mail: marie-jose.cote@inspection.gc.ca
Phone: +1 (343) 212-0239

Lecturers

Dr. Daniel Perry (Canadian Grain Commission), ISTA Variety Committee, DNA Working Group
Ms. Cheryl Dollard (CFIA), ISTA Variety Committee, DNA Working Group
Mr. Mark Forhan, CFIA, Variety Registration Office
Dr. Marie-José Côté (CFIA), DNA Working Group

Aim of the workshop:

The use of DNA-based molecular markers to genotype crop varieties has become a valuable tool to help in the identification of varieties. Therefore, the ISTA Variety Committee is announcing a Workshop on Variety Identification Using Molecular Markers to be held in Ottawa, Canada, from 7–10 July 2014. The workshop is intended to instruct the participant on the theory and practices of:

– Basic DNA techniques
– Genotyping methods
– Data interpretation.

Target group:

The workshop is destined to anyone involved with crop variety identification with no or beginner level knowledge of DNA-based molecular markers.

Workshop content

Lectures on:

– Genome organisation of bred plants
– DNA extraction
– DNA basics
– microsatellite markers
– SNP markers
– genotyping data interpretation

Laboratory hands-on sessions:

– sampling of suspected off-type in a field plot
– DNA extraction and quality assessment
– microsatellite assay on different platforms
– SNP assay on different platforms
– genotyping result data interpretation

Location

The workshop will be held in one of the CFIA Ottawa Laboratories situated at 3851 Fallowfield Road, Ottawa, Ontario. The hotel accommodation will be in downtown Ottawa (20 km). Transport from the hotel to the laboratory will be provided.

Accommodation

Capital Hill Hotel & Suites
88 Albert Street
Ottawa, Canada, K1P 5E9

Guest rooms

A block of standard executive rooms has been reserved for this workshop for the nights of 6–10 July 2014, at the special group rate of CAD 109.00 per room per night exclusive of taxes. This is for a guest room with either one queen, one king or two queen beds; kitchenettes are subject to availability at the time of individual reservations.

How to reserve by phone or e-mail

Guests may contact the hotel directly by calling +1-800-463-7705 or e-mail frontdesk@capitalhill.com to book their reservations and have them quote "Cnd Food Inspection Agency" to ensure this special group rate.

How to reserve online:

Guests may book directly online on the hotel web site at www.capitalhill.com and clicking on "Reservations", and then entering the following codes:

– group code: 651683
– PIN: 1234

ANNOUNCEMENT

Changing of the Guard on Parliament Hill, Ottawa. (Photo: Yann Fauché, Alma Mulalic)

Payment

Guests will be required to provide a valid credit card upon booking to guarantee their reservation, and will be responsible for payment of their own room, taxes and incidentals.

Cancellation

Individual guests cancelling their reservation must contact the hotel directly by 18:00 h (6 pm) on the day of arrival, to avoid cancellation charges (first night's room and taxes would apply).

Participation fee:

ISTA Members: EUR 450
Non-members: EUR 675

The participation fee includes all literature and supporting material for the workshop, lunches and coffee breaks, excursion to the field, workshop dinner and transfer between the workshop venue and hotels (except airport transfer).

It does not include accommodation or meals other than those specified.

The number of participants is for a **minimum of 12** and restricted to a **maximum of 18** participants.

If you would like to attend the workshop please fill in the registration form. An invoice will be sent to you, which has to be paid before the participation confirmation will be generated.

You can pay by credit card upon individual request to the ISTA Secretariat.

Registration and payment deadline is 1 June 2014.

Please note:

For cancellations made after 1 June 2014, registration fees are non-refundable. ■

ANNOUNCEMENT

ISTA Workshop on Seed Health Testing
Poznan, Poland, 4–7 September 2014

www.seedtest.org/shws914

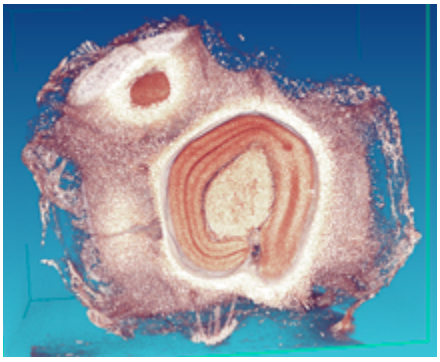
This Workshop is fully booked.

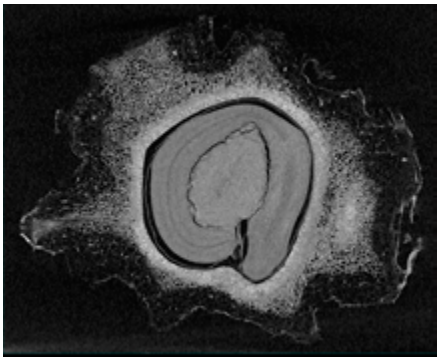
ISTA Hands-on Seminar on Seed Image Analysis
Angers, France, 14–17 October 2014

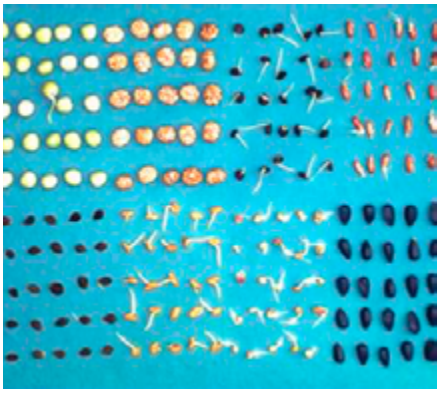
www.seedtest.org/atcws1014

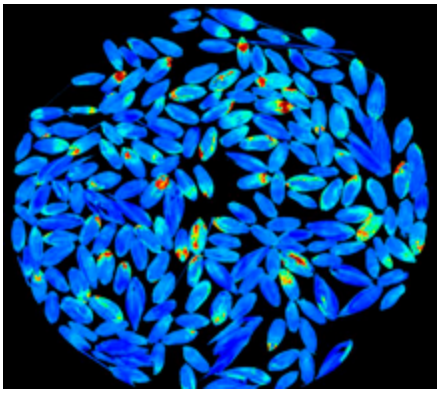
The ISTA Advanced Technologies Committee (ATC) and GEVES (Angers, France) are organizing an ISTA Hands-on Seminar on Seed Image Analysis.

In this Seminar, the participants will learn about and discuss the basics of various imaging technologies that are or may be applied in seed analysis. An essential part of the Seminar will be hands-on experience with the available equipment. The focus will be on imaging technologies and image analysis that are already available and being used in practice applied in research and seed evaluation.









Venue

The Seminar will be held from 14–17 October 2014 at the GEVES laboratories in Angers, France, a seed science inspiring environment in a historic city.

Registration

Registration will open 1 May 2014 and will be limited to 25 participants.

Organizing committee

Karima Boudehri, Bert van Duijn, Birte Boelt (ATC), Joël Léchappé (GEVES)

ANNOUNCEMENT

ISTA Workshop on Seed Health Testing
Depok, Indonesia, 10–14 November 2014

www.seedtest.org/shws1114

We are pleased to invite you to the ISTA-accredited seed testing laboratory ID01, Balai Besar PPMB-TPH, Jalan Raya Tapos, Depok, in Indonesia.

Venue
Balai Besar PPMB-TPH, Jalan Raya Tapos, Depok, Indonesia

Local organizer
Balai Besar PPMB-TPH, Jalan Raya Tapos, Depok, Indonesia
Tri Susetyo
E-mail: bbppmb_tph@yahoo.co.id

Lecturers
Valérie Grimault, Chair of the ISTA Seed Health Committee, Pathology Laboratory Manager at GEVES, France
Mark Buimer, Member of the ISTA Seed Health Committee, Routine Laboratory Manager at Naktuinbouw, Netherlands
Masatoshi Sato, Member of the ISTA Seed Health Committee and Executive Committee, National Center for Seeds and Seedlings, Director of Seed Health Laboratory, Japan
Corinne Sarniguet, specialist in nematodes, Laboratory of Plant Health (ANSES-LSV), France (lecture given by web training)
Bonny W. Soekarno, lecturer at the Plant Protection Department, Bogor Agriculture Institute

Aim of the workshop
The aim of this workshop is to improve our understanding and practical ability in seed health testing based on the ISTA Rules. This training course consists of lectures (L) and practical work.

Provisional programme
- An introduction to pests and seed infestation and to seed health testing (L)
- General introduction to seed health fungi and bacteria (L)
- Good laboratory practice in the seed health laboratory (L)
- *Xanthomonas campestris* pv. *campestris*: ISTA method 7-019 (L)
- Blotter tests for detection of fungi/rice: ISTA methods 7-010, 011 and 012 (L)

Palace of Bogor. (Photo: David Elit)

- Blotter test for detection of fungi/*Capsicum* (L)
- General introduction on the seed health virus (L)
- Critical Control Points in seed health testing (L)
- General introduction on the seed health nematodes (lecture given by web training)
- Molecular techniques in seed health testing (L)
- Quality assurance in seed health testing (L)
- ISTA seed health testing (sample size, subsample size, how to take subsamples, tolerance numbers, overview of ISTA methods) and method validation in seed health testing (general principles) (L)
- Practical work on bacteria and fungi
  - Bacteria: dilution, plating, selection of suspect colonies and sub culturing, PCR
  - Blotter test for detection of fungi in rice: ISTA methods 7-010, 011 and 012: plating of seeds, morphological identification
- Practical work on viruses (ELISA)
- Demonstration of nematodes (*Aphalenchoides besseyi on Orza sativa*)

Accommodation

There are three recommended hotels at Bogor. Participants are welcome to make their own hotel reservations.

Hotel Santika
Botani Square, Jalan Padjadjaran
Bogor 16127
Phone: +62 251 8400707
Fax: +62 251 8400706
E-mail: bogor@santika.com
Web site: www.santika.com

IPB Convention Hotel
Botani Square, Jalan Padjadjaran
Bogor 16127
Phone: +62 251 8345698, 8345699
Fax: +62 251 8345636
E-mail: reservation@ipbch.com
Web site: www.ipbch.com

Hotel Royal Amaroossa
Jalan Otto Iskandardinata No. 84
Bogor 16127
Phone : +62 251 8354333
Fax: +62 251 8351799
E-mail: royalbogor@amaroossahotel.com
Web site: www.amaroossahotel.com/royalbogor

Registration fees

ISTA Members: USD 600
Non-members: USD 900

The registration fee includes all literature and supporting material for the workshop, lunches and coffee breaks, excursion, workshop dinner and transfer between the workshop venue and hotels (except airport transfer).

There is a **minimum number of 20** participants required for this workshop to take place, with a **maximum number of 24**.

If you would like to attend the workshop please fill in the registration form.

An invoice will be sent to you, which has to be paid before the participation confirmation will be generated.

Payment by credit card is possible upon request to the ISTA Secretariat.

The registration deadline is 15 August 2014 and the payment deadline is 10 September 2014.

Please note: For cancellations made before 15 September 2014, registration fees are refundable less an administration fee of EUR 50. For cancellations made after 16 September 2014, registration fees are non-refundable. ■

ISTA Workshop on Seed Vigour

Bengaluru, India, 10–13 November 2014

www.seedtest.org/vigws1114

The ISTA Vigour Committee and Indo American Hybrid Seeds, Bengaluru (Bangalore), India invite you to a Workshop on Seed Vigour Testing. The workshop will be made up of lectures, interactive seminars and practical experience in vigour testing. It will also offer an opportunity for general discussion on seed vigour and time for participants to ask specific questions regarding vigour testing procedures.

Workshop content

- Introduction to seed vigour and its importance in crop production
- Conductivity test for *Pisum sativum*, *Phaseolus vulgaris. Glycine max, Cicer arietinum*
- Controlled deterioration test for *Brassica* spp.; application to other small-seeded vegetables
- Radicle emergence test: development and validation. Examples: maize, cotton, brassica, peppers, cucurbits, onions; general applicability
- Accelerated ageing test for soya beans
- Cold test for maize; cool test for cotton
- Physiological basis of seed vigour: the seed ageing/repair hypothesis
- Factors affecting seed vigour; avoiding the production of low-vigour seed
- Future developments in vigour testing
- Discussion on seed quality assurance and vigour

Practical work

All participants will gain practical experience in, and assess results from, conductivity, controlled deterioration, accelerated ageing, radicle emergence, and cold and cool tests.

Question and answer sessions

These will consider questions on all aspects of seed vigour and any vigour test.

Lecturers

Alison Powell PhD DSc, Chair of ISTA Vigour Committee, University of Aberdeen, UK
Stan Matthews PhD DSc, ISTA Vigour Committee member, University of Aberdeen, UK

Organizer

Dr. G.V. Jagadish
Seed Laboratory IN07, Indo-American Hybrid Seeds (India) Pvt. Ltd.
7th km, Banashankari-Kengeri Link Road
Kengeri Hobli, Channasandra
Rajarajeshwari Nagar Post
Bengaluru 560 098

E-mail: jagadish@indamseeds.com
Web site: www.indamseeds.com
Telephone: +91 80 2811356, 28612356, 28615104, 28611499
Mobile: +91 98 45274209

Location

The workshop will take place at Indo American Hybrid Seeds (India) Pvt., Ltd., Bengaluru for practical sessions. The theory will be presented at the Hotel Chancery, Lavelle Road, Bengaluru.

Indo American Hybrid Seeds, Bengaluru, India has a seed testing laboratory (IN07), accredited by the International Seed Testing Association and ISO 17025. In 2002 it was the first private laboratory in India to gain ISTA accreditation. The core business of Indo American Hybrid Seeds is the production and marketing of hybrid seeds, and the company established its seed laboratory for for purity, germination, vigour and seed health testing. More information about Indo American Hybrid Seeds, Bengaluru, India can be found at www.indamseeds.com.

Accommodation

Participants are asked to book accommodation directly with the hotels. Please indicate 'ISTA Workshop' when booking and inform the local organizer.

Workshop hotel:
The Chancery
10/6, Lavelle Road
Bengaluru 560 001
Tel: +91 80 22276767, 41188888
Fax: +91 80 22276700
www.chanceryhotel.net
Single room including breakfast:
INR 5500 (EUR 64)

Alternative accommodation:
Hotel Citrine
211, S.C. Road
Seshadripuram
Bengaluru 560 020
Tel: +91 80 4000 3000
E-mail: enquiry@thecitrinehotel.com
Single room including breakfast:
INR 4500 (Euro 52)

Hotel Hoysala
212, S.C. Road
Sheshadripuram
Bangalore 560 020
Tel: +91 80 4000 6000; +91 80 2346 4300
E-mail: enquiry@hotelhoysala.com
Single room including breakfast:
INR 2000 (EUR 23)

The Grand Meridien Hotel
117, Subedhar Chatram Road
Sheshadripuram
Bengaluru 560 020
Phone: +91 80 41241660
Fax: +91 80 23463310
E-mail: thegrandmeridien@gmail.com; info@thegrandmeridien.com
Single room including breakfast:
INR 2500 (EUR 29)

Registration fees

ISTA Members: EUR 500
Non-members: EUR 750

The registration fee includes all literature and supporting material for the workshop, lunches and coffee breaks, excursion, workshop dinner and transfer between the workshop venue and hotels (except airport transfer). It does not include accommodation or meals other than those specified.

There is a **minimum number of 25** participants required for this workshop to take place, with a **maximum number of 30**.

If you would like to attend the workshop, please fill in the registration form.

An invoice will be sent to you, which must be paid before participation is confirmed.

Payment by credit card is possible upon request to the ISTA Secretariat.

Registration and payment deadline is 15 September 2014.

Please note: For cancellations made before 15 September 2014, registration fees are refundable less CHF 50.00 administration fee. For cancellations made after 15 September 2014, registration fees are non-refundable.

About Bengaluru

Bengaluru is the capital city of the Indian state of Karnataka, located on the Deccan Plateau in the south-eastern part of Karnataka. Bengaluru is India's third most populous city and fifth-most populous urban agglomeration. Bengaluru is known as the Silicon Valley of India because of its position as the nation's leading information technology exporter. Located at a height of over 3000 feet (914.4 m) above sea level, Bengaluru is known for its pleasant climate throughout the year. The city is amongst the top ten preferred entrepreneurial locations in the world. ■

ANNOUNCEMENT

ISTA Workshop on Seed Sampling and Quality Assurance in Seed Sampling

Bengaluru, India, 17–20 November 2014

www.seedtest.org/bscws1114

The ISTA Bulking and Sampling Committee and the Indo American Hybrid Seeds, Bengaluru (Bangalore), India invite you to a Workshop on Seed Sampling and Quality Assurance in Seed Sampling in November 2014. The workshop will be made up of lectures, interactive sessions and practical experience in sampling of seed lots and evaluation of samplers. It will also offer the opportunity for general discussion of seed sampling and provide time for participants to ask specific questions regarding automatic samplers and different sampling methods and procedures.

Workshop content

The workshop will consist of lectures and practical exercises including evaluation and examination of candidates (written). It will offer the opportunity for general discussion on automatic and manual seed sampling and dividing, as well as quality assurance in seed sampling and monitoring of seed samplers. In connection with the lectures, there will be practical session on seed sampling and sample division. The session on quality assurance will focus on control, calibration and maintenance of automatic sampling and manual sampling equipment, as well as audit sampling and monitoring of seed samplers. The use of the ISTA Rules and the ISTA Handbook on Seed sampling will be discussed during the workshop, as well as the ISTA accreditation standard in connection to seed sampling. The language of the workshop will be English.

Programme overview

- Introduction to ISTA
- General principles of seed sampling and sample dividing
- Automatic seed sampler (installation, operation, approval and monitory check)
- Marking, labelling and sealing of seed lots and samples
- Sampling in relation to the ISTA Accreditation standard
- Quality assurance aspects in connection to automatic and manual seed sampling and dividing
- Control, calibration and maintenance of automatic and manual sampling and dividing equipment
- Audit of sampling and how to deal with non-conformities
- Monitoring of seed samplers
- Evaluations and examinations
- Trend analyses of samplers work
- Future developments and plans in the Bulking and Sampling Committee

Lecturers

Eddie Goldschagg, Chair of the ISTA Bulking and Sampling Committee (South Africa)

Gerry Hall, Member of the ISTA Bulking and Sampling Committee (United Kingdom)

Max Soepboer, former Vice-Chair of the ISTA Bulking and Sampling Committee (Netherlands)

Organiser

See ‘ISTA Workshop on Seed Vigour’, p. 47.

Bangalore Palace. (Photo: C. Arunrathnakumar)

ANNOUNCEMENT

Accommodation

See 'ISTA Workshop on Seed Vigour', p. 47.

Registration fees

ISTA Members: EUR 500
Non-members: EUR 750

The registration fee includes all literature and supporting material for the workshop, lunches and coffee breaks, excursion, workshop dinner and transfer between the workshop venue and hotels (except airport transfer). It does not include accommodation or meals other than those specified.

There is a **minimum number of 30** participants required for this workshop to take place, with a **maximum number of 34**.

If you would like to attend the workshop, please fill in the registration form.

An invoice will be sent to you, which must be paid before participation is confirmed.

Payment by credit card is possible upon request to the ISTA Secretariat.

Registration and payment deadline is 15 September 2014.

Please note: For cancellations made before 15 September 2014, registration fees are refundable less CHF 50.00 administration fee. For cancellations made after 15 September 2014, registration fees are non-refundable.

About Bengaluru

See 'ISTA Workshop on Seed Vigour', p. 47. ■

ISTA Quality Assurance Workshop for Advanced Laboratories
Bassersdorf, Switzerland, December 2014

Organizer

ISTA Secretariat
Zürichstrasse 50
8303 Bassersdorf, Switzerland

Contact person

Nadine Ettel (nadine.ettel@ista.ch)

Lecturers

Ronald Don, Technical Auditor, ISTA Honorary Life Member, Member of several ISTA Technical Committees
Rasha El-Khadem, Head of ISTA Accreditation and Technical Department, System Auditor

Aim of the workshop

To give experienced laboratories the opportunity to discuss and obtain inspiration on how to improve their quality assurance system and benefit from it.

Target groups

The workshop is for members of experienced laboratories that have already a well-running quality management system in place. The lecturers will focus on selected topics to be discussed.

Content

The workshop will consist of oral presentations, group work and exercises. The lecturers will try to involve the participants as much as possible. Participants are invited to bring their laptops along.

Some of the workshop content will deal with:

General management
Technical aspects:
- Statistical aspects of seed testing
- Calibration/verification of equipment etc.
- How to read uncertainty on calibration certificates

Internal quality control:
- Check testing, blind tests etc.
- Analysis
- Trends
- Monitoring of staff (seed samplers and analysts)

How to deal with non-conformities
Requirements of selected topics of the Accreditation Standard

The workshop will include an excursion in Zurich.

Location

ISTA Secretariat, Zürichstrasse 50, 8303 Bassersdorf, Switzerland

Accommodation

Participants are asked to book accommodation directly with hotels nearby.

Registration fee

Details will be published on the ISTA web site soon.

The registration fee will include all literature and supporting material for the workshop, lunches and coffee breaks, excursion, workshop dinner and transfer between the workshop venue and hotels (except airport transfer).

It does not include accommodation or meals other than those specified.

Registration

Information will be published soon on the ISTA web site:
www.seedtest.org/en/workshop.html ■

ISTA Workshop on Quality Assurance in Seed Testing for Advanced Laboratories Bassersdorf, Switzerland, 3–6 December 2013

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The ISTA Accreditation and Technical Department announced and organised at short notice an ISTA Quality Assurance Workshop for advanced laboratories at the ISTA Secretariat. We were overwhelmed by the number of interested persons.

25 participants from 17 different countries, covering nations from Africa, Asia, Oceania, America and Europe, attended the workshop. The participants were from governmental seed testing stations, research institutes, universities, and the seed industry.

The aim of the workshop was to present and discuss selected topics that are known to be challenging for advanced laboratories. In group work, the participants had the possibility to explore issues and set up new processes. Rasha El-Khadem, head of the ISTA Accreditation and Technical Department, and Ronald Don, ISTA technical auditor, delivered the lectures.

At the beginning the participants announced their expectations with regards to the workshop. Some of the expectations could not be covered by the presentations, as they were very specific and of interest for only a small group. In the following days it was possible to discuss these issues during coffee breaks with the participants in small groups. The other expectations of the participants were covered by the aims as outlined in the workshop announcement.

One of the technical focuses was on the management of equipment. The calibration and verification requirements of

laboratory equipment such as analytical balances, seed dividers and temperature measuring devices, and information on how to read calibration certificates were discussed in detail. Participants learned how to derive from the measurement of uncertainty whether equipment is fit for purpose.

The presentation "Statistical Aspects in Seed Testing" dealt with confidence intervals of test results showing that variability in seed testing is given and must be taken into account when comparing results of retesting in the same or in a different laboratory. Variability is also present when a new batch of substrate is used in the germination test. The ISTA Rules require laboratories to check whether the new substrate batch is suitable by using statistical tools. The participants were shown how to use a basic software tool to conduct an analysis of variance that enabled them to decide whether to accept or reject a new batch of substrate based on statistical data.

One morning was reserved for a presentation and group work on internal quality control aspects. Examples of possible programmes to monitor the performance of the laboratory and the laboratory staff were provided, and the groups had to develop and present their own programmes on monitoring for individual tests in the laboratory. The interest was very high and many questions were addressed and answered. Some other examples of topics that were covered were the checks performed on competency in hand halving and divider checks.

The group visited the Swiss ISTA-accredited official seed station of Agroscope and had a tour through the laboratory. The administration of incoming test requests as well as the management of data and issuance of national and ISTA Certificates was one of the aspects that were demonstrated to us. In the purity and the germination laboratories some of the tests performed by the laboratory were demonstrated, and the participants could observe the sample flow. The binocular purity work stations and the growing chambers and their temperature monitoring system were of special interest for the participants.

The group had a guided tour through Zurich city, starting from the main station. Fortunately, although the weather was cold, it was a bright day, and the view over the city and the lake was fantastic. The workshop dinner was held in a Thai restaurant where we could warm up with spicy and hot food.

We would like to thank the staff of the Swiss seed testing laboratory for their hospitality and the great opportunity to meet them and visit their laboratory. Our colleagues from the ISTA Secretariat must be thanked for the efforts put into the organisation and smooth workshop flow, as well as the continuous support provided during the workshop. Their contribution was very much appreciated by the lecturers and participants.

2014

12–16 May	**ISTA Quality Assurance Workshop** Depok, Indonesia www.seedtest.org/qaws514
26–28 May	**ISF World Seed Congress** Beijing, China www.worldseed.org/isf/congress.html
12–14 June	**ISTA Seed Health Symposium** Edinburgh, UK www.seedtest.org (see page 14)
16–19 June	**ISTA Annual Meeting** Edinburgh, UK www.seedtest.org (see page 17)
23–26 June	**ISTA Workshop on Seed Sampling and Quality Assurance in Seed Sampling (fully booked)** Edinburgh, UK www.seedtest.org/bscws614 (see page 18)
7–10 July	**ISTA Workshop on Variety Identification Using Molecular Markers** Ottawa, Canada, 2014 www.seedtest.org/varws714 (see page 43)
4–7 September	**ISTA Workshop on Seed Health Testing (fully booked)** Poznán, Poland www.seedtest.org/shws914
15–19 September	**11th Conference of the International Society for Seed Science (ISSS)** Changsha, China http://2014seed.doevent.com (see page 25)
14–17 October	**ISTA Hands-on Seminar on Seed Image Analysis** Angers, France www.seedtest.org/atcws1014 (see page 45)
10–14 November	**ISTA Workshop on Seed Health Testing** Depok, Indonesia www.seedtest.org/shws1114 (see page 46)
10–13 November	**ISTA Workshop on Seed Vigour** Bengaluru, India www.seedtest.org/vigws1114 (see page 47)
17–20 November	**ISTA Workshop on Seed Sampling and Quality Assurance in Seed Sampling** Bengaluru, India www.seedtest.org/bscws1114 (see page 49)
December	**ISTA Quality Assurance Workshop for Advanced Laboratories** Bassersdorf, Switzerland (dates to be announced; see page 50)

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