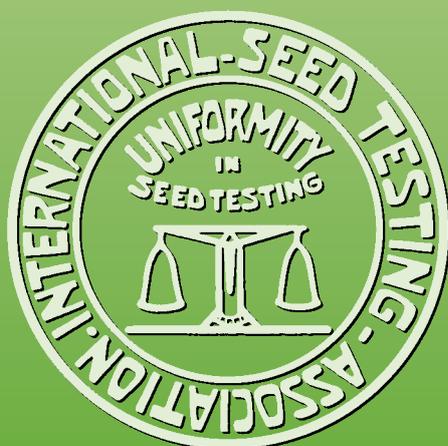


Seed Testing

INTERNATIONAL

ISTA News Bulletin No. 145 April 2013



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Seed Testing International
No. 145 April 2013
ISSN 1999-5229

Produced on behalf of the
ISTA Executive Committee

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Seed Testing International No. 146

Deadline for article submission: 15 August 2013
Publication date: October 2013
Circulation: 1500
No. of copies printed: 2000
Instructions to contributors: www.seedtest.org/STI

Other ISTA publications

For information on other ISTA publications, please contact the ISTA Secretariat or visit our web site at www.seedtest.org.

Photo credits:
Front cover: Ad Meskens

Dear Reader,

You may have heard of the reputed Chinese curse: "May you live in interesting times." Well, life at the Secretariat has been interesting over the past few months.

Interesting, yes; but thanks to the excellent work of the President and Executive Committee members, not as difficult as it could have been, given the extraordinary circumstances.

In ISTA, every third year is a Congress year, and 2013 is such a year. The Annual Meeting becomes a longer Congress, with a scientific symposium over several days, and, most importantly, the retirement of the President, and the election of a new Executive Committee and a new Vice President (with the old one becoming automatically the new President).

So normally, at this point the Secretary General would pay respects to the outgoing President, and thank them for the good collaboration during the past three years.

However, this year, we have the unusual situation that at the moment, we don't have a permanent Secretary General (which is why I am writing the editorial for this issue of STI). But on the other hand, also unusually, the President isn't leaving either.

But as you will see on page 4, a new Secretary General (Dr. Benjamin Kaufman) has been appointed, and also an interim one (Mr. Heinz Schmid) to take over until Dr. Kaufman can begin work. So the hard work of the Executive Committee is bearing fruit, and soon normality will reign again.

Further in this issue, of course, you will find updated information about the 30th ISTA Congress in Antalya, Turkey, which promises to be a very pleasant venue. In the final programme on page 15 there are more details of the 35 papers to be presented at the three-day ISTA Seed Symposium 2013, and of the discussion forums which will take place on Monday, 17 June, between the presentations of ISTA's technical work and the Ordinary General Meeting.

There are still places available for the pre-Congress Vigour Testing Workshop, but the Purity and Germination Workshop is already fully booked. There is also a selection of attractive post-Congress tours to some of Turkey's best cultural and historical tourist destinations.

Next to these articles relating to the Congress, you will find in this issue an overview on new technologies for seed purity and other seed testing, and two thought-provoking articles on some fundamental aspects of seed testing. I hope you will find them interesting reading.

Yours sincerely

Jonathan Taylor



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Kervansaray Hotel Lara,
Antalya, Turkey

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President's Report

Joël Léchappé



While I am writing this report, the Association and the Secretariat are in an interim situation with regard to the position of Secretary General.

I would therefore like to start this report by acknowledging the contribution of Dr. Michael Muschick, Secretary General of ISTA from 1999 to January 2013. During almost 14 years of service, first as Executive Officer, then as Secretary General, Dr. Muschick worked with scientists, politicians and laboratory experts. During this period, new regulations were introduced in many countries, new technologies were developed, and the economic situation became more difficult. In this framework, Dr. Muschick made an important contribution to ISTA's development, which was reflected in an increase in both membership numbers and ISTA's influence in the world.

The Executive Committee would like to thank Dr. Michael Muschick very much for his contribution to ISTA.

The Executive Committee has, of course, been looking for a successor to this position, and has found one in the person of Dr. Benjamin Kaufman, who will be well known to many of you. Since Dr. Kaufman cannot take up his post before 1 July, the

Executive Committee has also contracted Mr. Heinz Schmid, another familiar face to some, who will run the Secretariat until then. You will find more information on page 4.

We are coming to the end of the three-year period 2010–2013, and are preparing for the 30th ISTA Seed Congress in Antalya, Turkey. This period has been intensive, with the pace being set by both the statutory needs of the Ordinary Meetings and unexpected important events. Following the Articles of the Association (Article 14), I have served the Association as Vice President since June 2010, and then acting as President since November 2010, and will serve as President for the three coming years.

The actions taken during the past three years were based on the ISTA strategy approved at the Ordinary Meeting in Cologne, Germany, in 2010, and include seven key areas: membership, ISTA Rules, facilitation of seed movement, accreditation, dissemination of knowledge in seed science and technology, management of ISTA affairs, and communication.

The membership has regularly increased, and now includes 216 Member Laboratories from 76 countries and distinct economies.

With regard to the **ISTA Rules**, two particular examples show how they are being developed in response to the needs of the seed sector and to facilitate the movement of seeds. Certificates can now be issued for sublots without retesting, which means faster shipping of seed lots and lower costs. In addition, after several years of work with the seed sector and stakeholders, we now have Rules permitting large herbage seed lots.

There are new species, and new and simpler tests. Other tests for vigour, seed health and GMOs, including PCR methods, are on the increase. A new chapter on testing GMOs is being proposed, emphasizing the growing importance of these tests.

Statistical tools have also been regularly developed to support the tests. Today, statistics play an important role in seed testing. ISTA is thus very grateful to Dr. Julianna Bánai for her contribution to promoting statistics in our association. Dr. Bánai passed away peacefully in January 2013, at the age of 90. She had been an Honorary Life Member since 2010.

Accreditation has also made progress with the increase in the number of accredited laboratories to 124 in 59 countries. The professionalism and quality of the audit process as well as the proficiency test programme are high. Excellent proficiency test results demonstrate the over-proportional positive effect of excellence at ISTA laboratories – achieved through hard work and persistent improvements at the laboratory level, supported by the effective ISTA programme of audits and proficiency tests.

The programme of proficiency tests has been increasing in scope, and tests have been organized for seed health and forest tree seeds. The quality of the audits and the professionalism of the auditors and laboratories guarantee a high quality of seed testing and worldwide harmonization. This is unique compared to other accreditation systems, and contributes strongly to ISTA achieving uniformity in seed testing worldwide. The review of the audit process, initiated in 2012 together with representatives of the Designated Authorities and the ISF, is one of the major topics for the coming period, and will be part of the strategic goals for the next term.

Under the goal of **disseminating knowledge**, workshops were organized by Technical Committees, the Secretary General and the Accreditation and Technical Department. Also, every year, there was a seminar at the Annual Meeting. A joint session was organized with the ISSS, as part of their 10th Conference on 'Seed Science in the 21st century' in Brazil. One significant event was the signing of a memorandum with the Royal Botanic Gardens Kew,

which forms the basis for further collaboration between our associations. Two permanent ongoing scientific activities, which strongly contribute to positioning ISTA as a scientific and technical association, are the triennial Seed Symposium at the ISTA Congress, organized by Alison Powell, and our journal *Seed Science and Technology*, with Chief Editor Fiona Hay.

A focus on the **management of ISTA affairs** resulted in more efficiency in ISTA's essential functions within the Secretariat to better serve the Members and support the Technical Committees. For example, this has helped in the organization of proficiency tests and workshops, use of ECOM liaison officers and general support to Committees.

The finances have been carefully studied, with the implementation of a financial tool associated with time recording. Securities as requested by the law are in good progress, and reserves for coming projects are being built. ISTA is hence in a healthy financial situation.

Finally, the change of ISTA's legal status to become an association under Swiss law was a major step forward in ensuring a stable future for our association.

At the 2013 February Executive Committee meeting held in Zurich, together with the Technical Committee chairs, it was decided to provide ISTA with new tools to facilitate **communication** and provide easy access to information. In principle, all ISTA publications would eventually be available in electronic form. This process would begin with the ISTA Rules 2014 edition in English, French and German, and with Seed Testing International (STI). Further languages, such as Spanish, would follow as available. It was also decided to start the project to revise the ISTA web site and to implement it in 2013/2014. Remote conferencing would be introduced for ISTA meetings (e.g. ECOM meetings, TCOM meetings or meetings with the Secretariat staff).

We are now preparing the strategic plans for the coming period 2013–2016. This strategy is being built under consultation with the Technical Committees and the Membership for approval at the Ordinary General Meeting in Antalya. I would like to mention some of the major challenges we will have to face to further strengthen

the relevance of ISTA and its value to our Members and stakeholders.

ISTA's strength is its worldwide network of technical experts. The Membership is the basis of the contribution of these experts to ISTA work. It is becoming more and more difficult for many Members to get support from their organizations to invest time for ISTA work, or to attend meetings, mainly for economical reasons. In addition, we need to prepare for the future and to attract new and young people, students and scientists involved in seed science. To face these challenges, the benefits to Members and their organizations need to be explored.

Some important areas of the world have a deficit of trained analysts. This is crucial in regions where the seed sector needs to be developed. It is also an increasing problem in regions where basic seed-testing skills are considered to be old fashioned, or are in competition with new technologies. Maintaining and developing the capacity of seed testing worldwide is a major challenge which strongly needs the support of the seed sector and governments. I believe that ISTA has a role to play in providing training and knowledge, thanks to its experts in both basic and high technology tests, for most regulatory or traded species.

Harmonization in seed testing, achieved through International Orange and Blue Certificates, has been the ISTA's goal since it was created, strongly supported by the seed sector. This is implemented by three core activities, the ISTA Rules, the Proficiency test programme and the accreditation scheme. All three have their own challenges. The ISTA Rules need to find a good balance between a demand for flexibility, such as adopting in-house methods, and a need for standard methods. Our proficiency tests are unique, but rely on a high amount of voluntary support from Members. Without a new financial model, it will become very difficult, if not impossible, to provide proficiency tests for all accredited tests. The cost of audits for accreditation has been challenged, and a revision to match the needs of the seed sector is already a major goal for the next three years, as decided by the Membership at the 2012 Ordinary Meeting.

To provide easy access to information at limited costs for everybody is crucial to

support uniformity worldwide. The areas where ISTA can do this is by using electronic publishing and considering the use of electronic certificates, e.g. to speed up the issuing of test reports. An important project agreed by the ECOM is the redesign of the web site, which will help to implement other decisions, and which allows the study of other electronic tools.

ISTA, strong from 89 years of experience and collaboration with other organizations, is in a good position to contribute to facilitating seed trade both nationally and internationally. However, to implement its strategy, ISTA relies on the support of the governments, the seed sector and the active contributions of its Members. The Ordinary General Meeting during the triennial Congress is the opportunity to show this support by proposing and electing new Executive Committee members and a new Vice President. The current ECOM members have together done a lot of work for ISTA and welcome new active members from all regions of the world, to help motivate Members and develop new ideas.

I would like to conclude by inviting you to the 30th ISTA Congress in Antalya, Turkey. The organizing committee, represented by ECOM member Kamil Yilmaz, has prepared a very enthusiastic programme, in a wonderful environment. Two workshops are scheduled before the Congress, and at the Congress itself two fora on topics for the future: "Do the current principles and requirements for the ISTA Rules meet the future needs for developments in seed technology?", and "Use and international standardization of DNA technologies in the area of seeds". A strategy session will prepare the adoption of the goals for 2013–2016 to be voted on during the Ordinary General Meeting. See page 15 for the full programme.

June 2013 sees the end of my stand-in role, and the start of my term of office proper as ISTA President. I am looking forward to leading an association with a common aim and vision for seed testing, supported by the ISTA Membership, the ISTA Secretariat with the new Secretary General, and both 'old' and new faces elected onto the ECOM in June. ■

ISTA appoints Dr. Benjamin Kaufman as its new Secretary General

The ISTA Executive Committee is pleased to announce the appointment of Dr. Benjamin (Beni) Kaufman to the position of Secretary General of the International Seed Testing Association, beginning 1 July 2013.

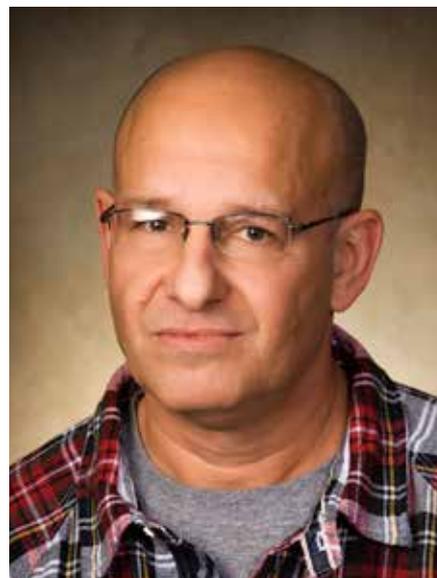
Dr. Kaufman has over 17 years of experience in developing and managing GMO and genetic purity testing laboratories in the private seed sector. He is also an experienced scientist in the area of molecular genetics analysis and related technologies. Dr. Kaufman is currently a member of the ISTA GMO Committee, and was a member of the GMO Task Force. He has also contributed to the ISTA Variety Committee, and participated in many ISTA Annual Meetings and workshops.

Dr. Kaufman has a Ph.D. in Molecular Genetics from the University of Illinois, and an M.Sc. from Tel Aviv University. He is currently the Manager of the Nucleic Acid Analysis Lab for DuPont Pioneer.

Dr. Kaufman's responsibilities as Secretary General will include managing the ISTA Secretariat, which supports and coordinates ISTA activities that include membership, the Technical Committees, and scientific and international relations.

The Executive Committee is confident that Dr. Kaufman will acknowledge this and will lead the Secretariat to new successes in serving the ISTA membership and their goals for the future. Everyone's talents and experience in the Secretariat are very important and will form the basis to work as one team along with the Executive Committee to share the coming challenges and successes.

The ISTA Executive Committee wishes Benjamin Kaufman all the best in his new position of ISTA Secretary General, and looks forward to working with him. ■



ISTA appoints Heinz Schmid as Secretary General ad interim



Since Dr. Kaufman cannot take up his duties before 1 July 2013, the ISTA Executive Committee has sought to fill the gap with an interim solution.

Heinz Schmid, a former ISTA Executive Officer from 1992 to 1999, has been contracted to take charge of the Secretariat for a period of about three months on a part-time (60%) basis, starting from 11 March.

Together with his wife, Mr. Schmid now runs his own consulting company, which is mainly active in the sectors of sustainability, company excellence, and leadership and personal development. He still knows ISTA very well, and has kept contact with the Association by, for example, holding the position of quality delegate of the Swiss seed testing laboratory up to last year. He

is also a consultant to seed laboratories, in particular in Asia and South America, to help them achieve ISTA accreditation. To date he has performed more than 100 ISTA audits as a system auditor.

Heinz Schmid will concentrate on routine operations and preparations for the Congress, until Dr. Kaufman takes over as the new Secretary General.

Heinz Schmid will usually be available at the ISTA Secretariat on Mondays, Wednesdays and Fridays. His e-mail address is heinz.schmid@ISTA.ch.

The ISTA Executive Committee kindly invites you to give your full support to Heinz Schmid during his interim management mission. ■

New technologies for purity and other seed determinations: what is being used and what do Member Laboratories want?

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Introduction

Purity analysis, including purity separations and other seed determinations, requires years of experience and training, and in some cases can be very time consuming. Depending on the crops, some laboratories face serious challenges when making such separations. The extensive labour and associated costs can result in increased analysis time and costs which have a serious impact on the financial sustainability of seed-testing laboratories. New technologies to speed up purity separation or seed identification would be most welcome.

In spring 2012, in order to gain an insight into the new techniques and equipment that laboratories may already be using today, the ISTA Purity Committee conducted a survey. The aim of the survey was also to collect ideas or wishes for future innovations, methods and devices.

The purpose of this article is to share the results of the survey, and to discuss how the new suggested ideas could be implemented and the existing technologies improved, so that more laboratories can benefit from these technologies.

Survey methodology

A questionnaire was distributed by the ISTA Secretariat on behalf of the Purity Committee. It was sent to all 210 ISTA laboratories on 15 February 2012. By 15 April 2012, a total of 57 answers had been received, a response rate of 27%. This response rate is high, considering that most laboratories use traditional equipment and may have felt that there was no need to answer the questionnaire.

To assess which new techniques and equipment are already in use in ISTA laboratories, the survey asked the following questions:

- ‘Is your laboratory using equipment, a procedure or technique, which in your experience is a new technology, or which you have acquired in the last 10 years?’
- ‘Would that new technology be helpful in other laboratories?’

The answers to these questions are discussed based on the experience of the authors.

To assess which new techniques or equipment may be needed in the future, the following question was asked:

- ‘What critical technologies do you think we need to develop or incorporate into purity testing in the future?’

Questionnaire results

Uniform blowing procedure

The uniform blowing procedure is widely used in laboratories that test grass seed crops, to separate empty florets and other lightweight inert matter from pure,

well-developed seeds. ISTA has established blowing procedures for *Dactylis glomerata* L., (orchardgrass/cockfoot), *Poa pratensis* L. (Kentucky bluegrass/smooth-stalked meadowgrass) and *Poa trivialis* L. (rough bluegrass/rough-stalked meadowgrass).

However, the survey responses indicated that laboratories are using the blowing process in a broad range of species to make preliminary separations, in order to increase the efficiency and effectiveness of the purity analysis.

Despite the potential applications of the uniform blowing procedure, the use of this technology is still limited. Its applications can be expanded to additional species, to achieve greater consistency among laboratories in separating lightweight inert matter. Blowers that can handle large sample sizes in various grass crops and cereals are needed. Blower monitoring technique using anemometers (Fig. 1) should be used, and should make this process more user friendly for better quality control and record keeping. These goals require sustained research and development. For related information on this subject, see Seed Testing International 138, October 2009.

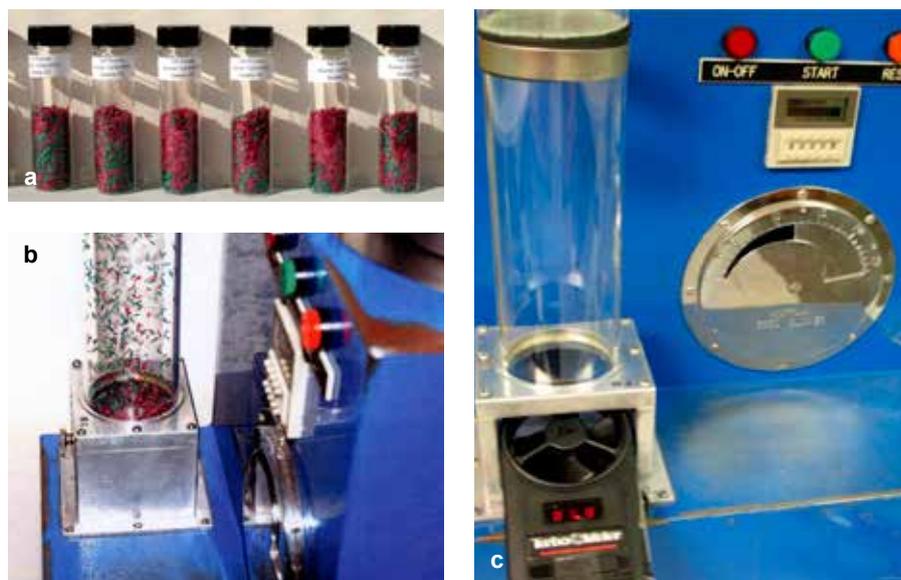


Figure 1. Master calibration samples (a) are used to find the right air gate opening (at the optimum blowing point, b). Then the equivalent air velocity (EAV) is measured immediately using an anemometer, to determine the correct setting indefinitely (c).

Ergovision system

An important aspect for seed testing laboratories is the ergonomic working conditions of the purity analysts. One laboratory in the USA has developed a purity testing system called the Ergovision system, which is mainly used in purity testing of small-seeded species such as grasses or vegetables. Its value lies in its ergonomic design, a fibre-optic light for image clarity, optimum magnification, and an automated seed flow in the field of view (Fig. 2). With sufficient practice and proficiency, this system can lead to higher productivity in purity testing of grass seeds. For more information on this system, see Seed Testing International 139, April 2010.

Molecular technologies

Molecular methods such as SDS-PAGE and SSR markers are being used in a few laboratories, mostly for variety identification, and in some cases to assist analysis when more detailed variety analysis and confirmation of a variety is needed.

With additional research, this technology can be expanded for use with seeds that cannot be distinguished simply by morphological characteristics. For example, since this survey was conducted, some laboratories in the USA are using the PCR-based ryegrass allelic discrimination test, to distinguish annual-type ryegrass seedlings from perennial-type ones. In the future, similar technologies will be necessary to address many seed identification issues when seed morphology is not sufficient.

Microscope purity station with built-in transmitted light

Microscopes with built-in transmitted light are already common, especially in laboratories which test small seeds. While only two laboratories indicated that they have purity stations combining a microscope with built-in transmitted lighting for inspecting seeds, others may have similar set-ups. Laboratories testing grass seed require a diaphanoscope with transmitted light of some type to determine whether seeds contain caryopses or are empty (Fig. 3). Also, the degree of endosperm development can be judged, and with enough experience, caryopses can also be differentiated from stamens or anthers.



Figure 2. Purity testing using the Ergovision system, with features including an ergonomic position for analysts, high quality optics, lights, and a mechanical seed feeder.

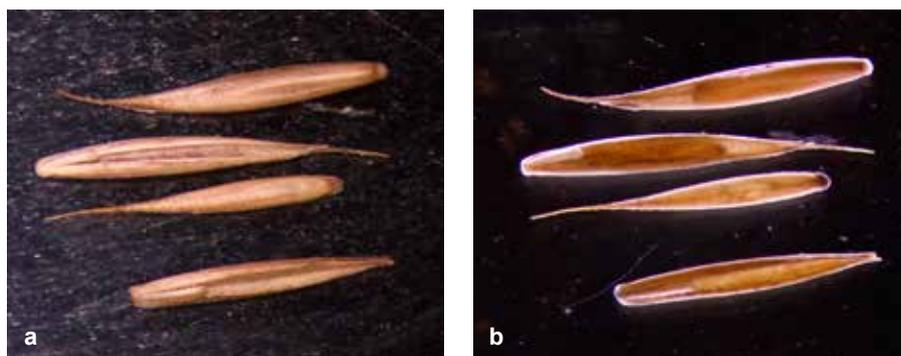


Figure 3. a Seeds of *Festuca rubra* as seen in the microscope with light from above. b The same seeds with LED light transmitted from below, showing that the top two seeds are filled and the bottom two are empty.

Seed scanner

As purity analysis is very time consuming, especially for small seeds, a seed scanner that does part of the separation work is of much interest. Few models are available in the market today. Some laboratories believe that the ones that have been presented so far do not produce accurate results.

A seed scanner normally consists of a camera connected to a computer, and the system is used for identifying seed species. With this system, samples are separated into good seeds and questionable seeds, including inert matter (Fig. 4). Two laboratories, including the Swedish laboratory, indicated that they use a seed scanner for cereals when carrying out determinations of other seed.

Before the seed scanner was used in the lab in Sweden, many analysts suffered from neck and shoulder pain from examining many samples containing large quantities of seed. Different solutions were tried to solve the problems, but without much success until this new technology was adopted. Approximately 2500 samples are run in the seed scanner each year. The machine sorts out around 10% of the sample, which means that the analyst must go through a sample of only approx. 100 g instead of 880–1000 g. The scanner can be loaded with up to 30 samples at a time and work during the night if necessary. It takes time to load, empty and clean the scanner, but it still saves a great deal of time. So far, this scanner is used for cereals, and can be of particularly benefit for laboratories that have a large throughput of cereal samples.

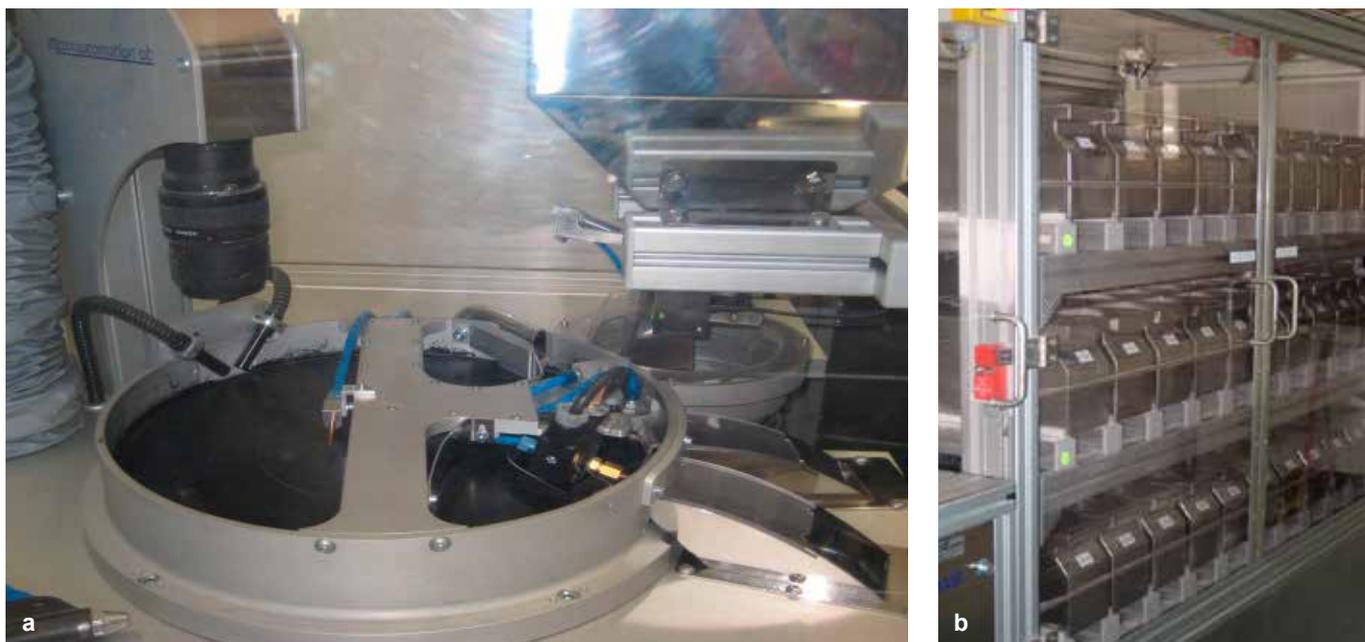


Figure 4. Seed scanner. **a** Each seed passes a camera that determines whether it is a good seed or a questionable seed, and is put in one of two boxes, depending on the decision. **b** The scanner can be loaded with up to 30 samples.

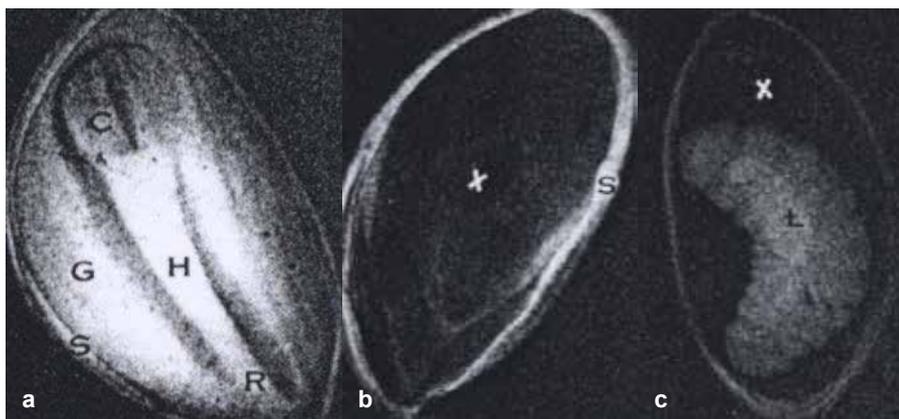


Figure 5. X-ray images of seeds of *Pseudotsuga menziesii* (Douglas fir). $\times 9.5$. **a** Normal seed. C: cotyledons; H: hypocotyl; R: radicle; G: gametophyte tissue; S: seed coat. **b** Empty seed surrounded by seed coat. **c** Insect infestation. Larva has completely eaten the seed tissues (adapted from AOSA Handbook No. 31).

X-ray analysis

Two laboratories use X-ray technology, but not for purity analysis. One laboratory indicated that it is used to monitor a seed cleaning process to separate filled and empty seeds. The other uses X-rays to detect physical or insect damage, or the level of seed filling (Fig. 5). It should be noted that digital X-ray machines are more user friendly than film-based ones. Digital X-ray machines are already available on the market and generate images immediately. This technology could be used in combination with blowing procedures to achieve effective separations, even with seed structures where the degree of seed development

is not visible, such as in *Asteraceae* and *Rosaceae*. Furthermore, this technology offers the ability to store all image information electronically for later verification or any other purpose.

Wish list for future purity testing

A summary of the wishes of laboratories participating in the survey is shown in Figure 6. Some of the suggested techniques or equipment, such as scanners, molecular techniques and X-rays are already being used in some other laboratories, as discussed above. Here is a summary of the responses.

Seed scanners

There is a general interest in seed scanners (20 answers) for saving time and reducing costs. The expectation is to use scanners for a broad range of species. The authors see the need for research and development to increase the efficiency and accuracy of existing scanners. For example, now that precision blowers for large samples are becoming available, it would perhaps be possible to load already blown samples to achieve greater separation efficiency in scanning.

Digital seed images

There is interest in readily available high-quality digital seed images for use as a virtual herbarium to assist with seed identification. Many ISTA laboratories have the capacity to generate high-quality images to respond to these needs. Some universities, e.g. Colorado State University, have images available on the web. One of the on-going projects in the ISTA Purity Committee is to develop images for the Universal List of Species, and another project being developed in Brazil is a collection of images of tropical seed species.

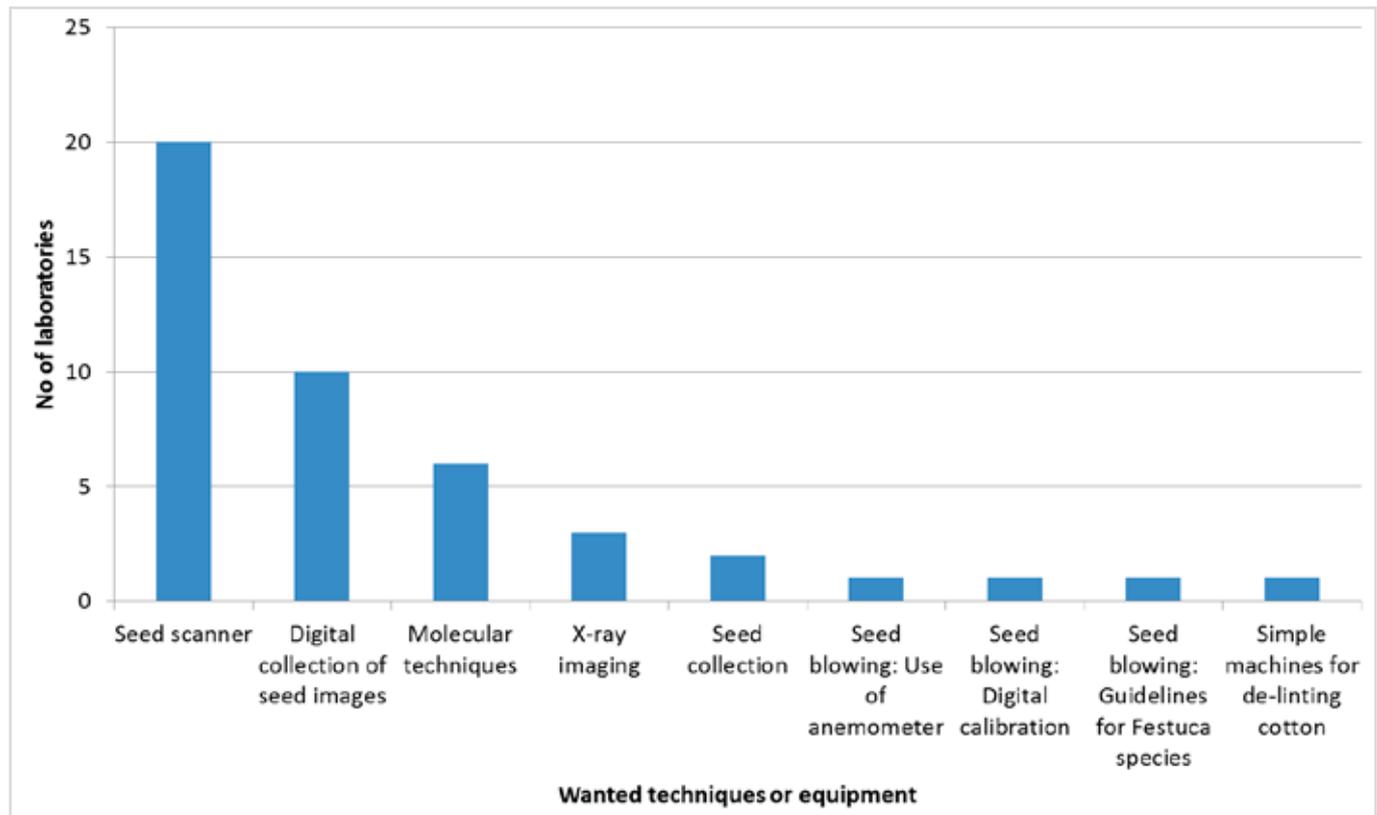


Figure 6. Techniques and equipment that the laboratories would like to use/ have access to in the future to carry out their purity analyses.

Blowing procedures

Several aspects of blowing appear to be of interest. Research is currently in progress by a working group of the ISTA Purity Committee to verify the uniformity of calibration samples from ISTA and AOSA, and to introduce anemometers to the ISTA calibration system.

One factor that may be inhibiting laboratories from using blowing procedures is the cost of the General blower. Thus research is needed to determine whether lower-cost blowers could be used for standard testing with calibration samples.

Seed collection

One respondent indicated the need for a collection of the 130 species in the ISTA Universal List of Species. This request has been heard on other occasions. This could be an indication that there is a market for this type of service.

Cotton delinter machine

One responder indicated the need for small, laboratory-scale cotton delinter machine. This may be an opportunity to carry out research and development to produce table-top equipment.

Discussion

Testing services, like any other business, must be of value and delivered efficiently, and at a cost that allows the laboratory to be competitive and remain in business. This is especially important when there are less public or government funds available to finance testing services. The lack of cutting-edge technologies to achieve higher levels of efficiency is limiting the capacity of laboratories to respond efficiently to the broad and evolving needs of the seed industry. Thus, innovation must continue.

The survey demonstrates that some laboratories are already using many such technologies for their purity testing services. It was also interesting to see that some of these often remain a wish. This may be partially due to lack of funds, but also due to lack of information or familiarity with the new technologies. Hopefully, this article and future presentations will help to provide new information.

The survey also created a way to collect new ideas for future technologies. This is a good reminder that all innovations start with good ideas. Some ideas, such as developing and having access to a digital seed herbarium appear perfectly feasible. Making table-top delinting equipment for cotton is equally possible. The question is who will do what and by when?

It was gratifying to see that some laboratories are thinking outside the box. One perfect example is the suggestion to use digital X-rays to see the caryopsis or embryo or other structures inside the seed coat. Perhaps, one day we will be able to see through any seed. Another example is the idea to calibrate the blowers digitally.

One final comment is to highlight the importance of innovation in purity and seed determinations. However, this is not something that can be accomplished by a survey. Innovation should be a permanent effort by each and every analyst who conducts purity testing. If we want to remain relevant, innovation is the only way. ■

Test development and validation: can ISTA's current approach apply to future developments?

Alison A. Powell

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Prior to the Annual Meeting in Venlo, ISTA held a seminar on 'New developments and technologies in seed testing'. A range of new and potential technologies were presented and discussed, including DNA-based technologies, machine vision, X-rays, physiological measurements and water activity. The seminar finished with a discussion session on 'New technologies and ISTA rules, needs and implementation barriers', which was introduced by a presentation on the 'Steps towards ISTA Rules' as a stimulus for discussion. This article summarises this presentation, and poses questions that need to be considered to enable ISTA to determine its future role in relation to the technologies that have been and are being developed.

The article has two aims. The first is to consider the work and information currently necessary to satisfy the requirements for any test method to be considered for validation by ISTA and, if desired, be proposed to be included in the ISTA Rules. The second aim is to question how test development and validation will proceed in the face of the development of advanced technologies and equipment.

Currently, the essential requirements for any test method considered for validation are proof that a test is **fit for purpose, repeatable and reproducible**.

Only when these requirements are met can all stakeholders in the seed industry, from seed producers through to the end user, be confident that a quality evaluation test does what everyone thinks it does.

There are three steps towards the development of a seed quality test method to the stage that it might be proposed to be included in the ISTA Rules. These are **research, development and validation**.

There is considerable information available within ISTA about what the last stage, validation, involves. However, the two steps before validation, research and development are equally important. The importance of these steps and what they involve is often not recognised, even though much of the information gathered during these steps is essential for a test to be taken forward to validation.

Research

Research establishes the principle of an idea, often in only one laboratory. Research should start off with a working hypothesis, the scientific term for an idea that will be tested in the research. To take an example from vigour testing, this might be that differences in solute leakage from seeds of grain legumes, measured using an electrical conductivity meter, will distinguish differences in the ability of seed lots of grain legumes to emerge in a wide range of conditions in the field. This idea, or hypothesis, is then tested, often on a limited number of selected samples that are expected to show differences in seed quality. These may be commercial seed lots, but during the research phase of the work they could also be samples selected for specific characteristics, in this case leakage differences. Thus both leakage (conductivity) and field performance would be evaluated and compared.

If the results of initial work support the hypothesis, i.e. leakage/conductivity relates to emergence, the hypothesis can be tested further. For example, the solute leakage (conductivity) could be tested for a larger number of commercial lots, followed by field trials on a number of lots that represent a range of leakage. Again, the leakage can be compared to the field emergence to examine whether the hypothesis is supported.

To proceed to the **development** phase, the research work on a test method should therefore provide:

- data to support the hypothesis;
- basic information that the test is fit for purpose, i.e. it meets the objectives of a chapter in the ISTA Rules.

For the above example, a relationship between conductivity and field emergence both supports the hypothesis and provides information about the planting value of seed lots in a wide range of environments, the object of a vigour test (ISTA, 2013). This is a sound basis on which the test can be taken to the development stage.

Development

Development of a test method should:

- extend the principle established during the research phase to commercial seed lots, since it is to such lots that the test will be applied;
- provide further evidence that the new test is fit for purpose;
- consider whether biological variables might influence results, e.g. dormancy, seed size, variety, seed moisture content;
- Consider whether experimental variables might influence results, e.g. temperature, time, humidity;
- examine repeatability and reproducibility in a few (2 or 3) laboratories.

This phase might therefore involve several laboratories testing the conductivity and field emergence of a number of commercial seed lots. The characteristics of the seed lots would cover appropriate biological variables for the test.

The above example has considered the research and development that may be involved for a completely new test method. A similar, although less extensive approach would be applied if, for example, new test conditions were being proposed or a new species added to an existing test.

At the end of the Research and Development stages, there should be data indicating that a test is fit for purpose and shows basic repeatability and reproducibility in a limited

number of laboratories. *Only then can a test be considered for validation. In some cases such data will be published, in others it may not be. Even so, the data must be available.*

Validation

The full details of the ISTA Method Validation Programme can be found on the ISTA web site, but typically validation involves six laboratories testing six commercial seed lots following a prescribed procedure. After validation, a proposal may be put forward to include the test in the ISTA Rules, but this does not have to be the case. Tests can be validated, but not included in the Rules.

The future of test development and validation

The above process of test development has been applied to tests currently in the ISTA Rules, even though the steps described above may not have been specifically distinguished. However, reviews of test development and 'validation', such as those by Prof. Steiner and his colleagues from the University of Hohenheim in Seed Testing International (Steiner *et al.*, 2008, 2009), clearly show that ISTA tests of seed quality have always been based on sound scientific principles and publicly available data that have been thoroughly evaluated.

What about the future for test development and validation? There are two groups of tests that are now coming into the spotlight. Let's consider some of the aspects of new tests that are being developed and how these might satisfy the requirements for validation described above.

New methods that use advanced techniques

Background research and development can establish whether a method is fit for purpose and indeed this has been done for many DNA-based techniques. The application of these techniques is becoming widespread and hence validation studies between laboratories should be feasible, even if their organisation may be demanding. Development and validation of other techniques that might be described as 'generic' or are not based on single pieces of equipment could also be envisaged.

Methods using equipment being promoted as able to assess aspects of seed quality

There are a number of aspects of methods based on using newly developed equipment that need to be taken into account if ISTA is to consider validating such methods:

- The equipment involved in such test methods is often expensive and being developed commercially.
- Little information is often provided on appropriate development work for such methods to establish whether a piece of equipment is fit for purpose.
- Promotion of the method or equipment is frequently based on the data from the research phase of test development, in which selected and not commercial seed lots are used.
- If extensive development work is done, it is rarely reported publicly, and hence judgments on the efficacy of a method or equipment cannot be adequately made by potential users in the seed sector.
- Comparisons of results obtained using the new equipment-based method with those obtained using existing methods are rarely made.
- Validation could be a problem when expensive equipment is involved, because limited numbers of laboratories will be available for a comparative test. In addition, when equipment has been bought, people are often reluctant to admit that it might not do a job properly, and if a laboratory is provided with equipment for free, this can place pressure on the laboratory to support the manufacturer. Both scenarios create a conflict of interest in the satisfactory comparative test as part of a validation.

This gives rise to questions whether ISTA can or should be involved in validating and/or supporting test methods that are based on equipment developed commercially. It is understandable that developers of such methods would like to have an 'endorsement' of their equipment by ISTA by validation through the Method Validation Programme. However, ISTA should consider whether this is an appropriate role for the Association.

This article is intended to stimulate thought amongst Members prior to the discussion forum to be held on 17 June as

part of the ISTA Congress. This forum will consider:

'Do the current principles and requirements for the ISTA Rules meet the future needs for developments in seed technology?'

The following questions, based on the above article, may provide some food for thought and stimulate discussion!

- **Should the current Method Validation Programme apply to all advanced methods?**
- **How can ISTA ensure that appropriate development work has been done by the proposer of the test or equipment?**
- **Can the Method Validation Programme be applied to methods based on use of equipment?**
- **Would ISTA's independence be questioned if it is involved in validating equipment that will be (or already is) commercially available for sale?**

Evidence for the keen interest in the commercial development of methods and equipment for seed testing has been highlighted by Dennis TeKrony (TeKrony, 2012). He found on the US patent website that 106 and 40 patents were registered in the areas of seed germination and seedling vigour respectively. He expressed concern that, as a result, methods and equipment would not be available to everyone. A further concern is that it is difficult for the seed sector to assess whether the claims of such patents are justified. Therefore:

As an alternative to validation, should ISTA provide guidelines to assist potential users of new methods or equipment in their evaluation of their suitability for purpose?

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Uniformity in seed testing – flexibility for ISTA?

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History of uniformity in seed testing

In the 19th century, there was no uniform seed testing. To protect the seed trade from widespread fraud, criminal laws were enacted (Nobbe, 1875; Steiner, 2000a). In order to improve this intolerable situation, in August 1869 Friedrich Nobbe, in Tharandt, Saxony, initiated seed testing by publishing his “Statute concerning the Testing of Agricultural Seeds”. This statute primarily contains rules for sampling seed lots, and considers the importance of standardized germination determination (Steiner and Kruse, 2007). Nobbe realized that seed is an article of trade. To support trade, sellers and buyers of seeds require reliable test results, all the more if they are located in different countries. In addition, supervising authorities are involved (Steiner, 1994).

Consequently, in 1875, Nobbe organized the “The 1st Meeting of the Directors of Seed Testing Stations in Graz”. There, detailed methods for seed testing were discussed, voted on and, with a view to the international seed trade, urgently recommended for uniform use (Steiner *et al.*, 2011b). Everywhere, this started activities to standardize existing methods and to develop additional methods. Already in 1878, the 2nd Meeting in Hamburg had coined the motto “uniformity in seed testing”. In 1893, the first official seed group was formed as the Permanent Committee for Seed Testing within the Association of Agricultural Experiment Stations in the German Empire (LVS) for elaboration

of standardized seed testing methods. In 1900, this Committee published the Technical Rules for Testing Seeds, obligatory for use in Germany (Steiner, 2000a).

In other countries, similar activities were begun. In 1906, at the 1st International Conference for Seed Testing 1906 in Hamburg, four national seed testing rules were presented, namely from Germany, Russian-Poland, Scandinavia and the USA (Steiner and Kruse, 2006). By way of example, two years later in the USA, the Association of Official Seed Analysts (AOSA) was founded, and published the first AOSA Rules for Testing Seeds in 1916. After an interval during World War I, the European Seed Testing Association took the lead in 1921, with the International Seed Testing Association (ISTA) taking over in 1924 (Steiner, 2000b). ISTA adopted the well-known motto “Uniformity in Seed Testing”.

Early work on establishing methods for seed testing was presented exemplarily by Steiner *et al.*, (2008, 2009). Comparative testing for the elaboration of standardized methods was followed by referee testing and, nowadays, proficiency testing (Steiner *et al.*, 2011a; El-Khadem, 2011). Throughout, the ultimate goal remained to strongly promote uniformity in seed testing by identifying the best suitable methods.

Uniformity, method development and diversity in seed testing

Uniformity in seed testing, of course, does not imply that for a species there is solely one test, and that this one test is unalterable. For most testing situations the ISTA International Rules for Seed Testing (Rules) provide parallel methods. For example, in germination testing different substrates may be used, different temperatures may be applied, the point of final count may be extended, different measures can be taken for advancing germination or breaking dormancy, and even other types of test, such as the tetrazolium test or the excised embryo test, may be feasible. However, all parallel methods have in common

that they have been validated by the ISTA validation system.

Thus, together with the discretion and experience of a laboratory, uniform seed testing is a versatile tool. Moreover, when a method is incorporated into the Rules it is not fixed, but subject to continual examination for performance and suitability. This way, there is an active monitoring resulting in continuous work for improving existing methods and elaborating new methods.

Beyond this, entirely new types of methods may be developed and open unforeseen perspectives. This is the task not only of the ISTA Technical Committees (TCOMs), but of all who are engaged in seed science and technology or in seed production and trade. ISTA is based on the awareness and competence of active experts and takes up impulses from the market. Everybody is requested to contribute. In consequence, the ISTA system ensures that, while uniformity is maintained, the evolution of the Rules is a permanent process supported by the seed community as a whole.

Importance of the ISTA Rules for the existence of ISTA

ISTA Article III reads: “The primary purpose of the Association is to develop, adopt and publish standard procedures for sampling and testing seeds, and to promote uniform application of these procedures for evaluation of seeds moving in international trade” (ISTA, 2012). Therefore, the task and the obligation of ISTA are clear. Continuous work for improving the Rules must follow actual needs, e. g. introduction of new species, improvement of sampling, elaboration of new seed health tests, or provision for new breeding categories. The ISTA Executive Committee (ECOM) promotes and supports the activities of the TCOMs aiming at establishing validated methods. The Members – at present representing 79 governments from all over the world – must approve by majority vote any new method prior to incorporation into the Rules. This constitutes the universal

basis of the Rules and with it the existence of ISTA itself. In short: the Rules are ISTA; no Rules, no ISTA.

The Rules are the basis for making out ISTA Certificates. An ISTA Certificate accompanies a seed lot documenting its quality status. An ISTA Certificate is an international passport to markets and mandatory for export and import in numerous countries. An ISTA Certificate is independent, transparent and authentic. Not least, the ISTA Rules and Certificates are embedded in the ISTA system of laboratory accreditation. ISTA laboratories are regularly checked by audits and by proficiency tests (Steiner *et al.*, 2011a; El-Khadem, 2011). All this makes ISTA Certificates reliable. The international seed trade needs

absolutely reliable information. Hence, results based on ISTA Rules and documented on ISTA Certificates facilitate seed trading. They form a secure basis for contracts, allow monitoring by authorities, and facilitate arbitration in the case of disputes. The ECOM takes responsibility for considering the global aspects.

New situation in a special case

In the 1990s, the discussion about seeds of genetically modified organisms (GMO) started. The ECOM, considering ISTA's international responsibility in the seed trade, decided to become active in this new area of molecular methods.

In 2002, at a special meeting in Charlotte, NC, USA, with the ISTA President attending, a proposal was elaborated by the chairs of the GMO Task Force and the Sampling, Variety and Statistics Committees, together with specialists in DNA testing (ISTA 2004). It soon became evident that in the current situation it would not yet be possible to develop uniform methods, mainly for two reasons. On the one hand, there was the need for expensive equipment and specifically trained staff, on the other, it was obvious that the rapid progress in DNA analysis techniques at that time hardly allowed the establishment of uniform testing methods. To overcome these obstacles, the performance-based approach (PBA) was proposed and accepted at the ISTA Ordinary Meeting in Bangkok, 2005, as a unique exception to the ISTA principles, and consequently only as an interim solution (ISTA, 2005).

The measures to be observed with the PBA in order to remain within the requirement of uniformity, at least with regard to the results, were: (i) Each laboratory has to validate its method internally according to the ISTA prescriptions. (ii) Each laboratory has to participate each year in the two to three rounds of proficiency tests (PT).

These PTs are prepared by the GMO Committee together with the Statistics Committee. Each PT round is composed of up to 30 single samples with a defined content of GMO seeds. This requires highly elaborate and costly checking.

Beforehand, both the non-GMO and GMO seed lots must be strictly tested for varietal purity. Then, the samples are spiked and randomized. Sending 30 samples to 70 laboratories results in 2100 samples (Fig. 1). The results are collected, checked by the GMO Committee, and evaluated by the Statistics Committee. With the laboratories in code, the results are published on the ISTA web site. Thus, methods and reproducibility are publicly communicated, and this approach was therefore accepted by the partners in seed trade as well as by the authorities.



Figure 1. Samples for GMO Proficiency Test Round 4 ready for shipment worldwide. Each box contains 12 × 3000 seeds of *Glycine max*, the record sheet, the phytosanitary certificate and the shipment documents in the languages of the countries of destination. (LTZ Augustenberg, Karlsruhe, Germany)

In the meantime, DNA testing has become routine, and according to the decisions of 2005, the ECOM should now consider the addition to the Rules of uniform methods for testing for GMO seeds. An additional substantial aspect to support this is the exceptionally laborious and costly implementation of the obligatory PTs.

ISTA and “flexibility”

At the ISTA Annual Meeting 2012, under the catchphrase “flexibility”, it was proposed to use a kind of PBA also in germination testing (Burg 2010, 2012). It was claimed that with GMO testing, ISTA had introduced the principle of PBA into the Rules. Hence, this procedure could be extended to other Rules Chapters, such as germination testing. It was argued that by doing so, method development would be speeded up, and the TCOMs released from validation work. Each laboratory could validate its own in-house methods. The final validation would be simply the comparative testing of the in-house methods with an ISTA standard method, by testing three samples together with two neighbouring laboratories. When working with in-house methods, the laboratory would indicate on the ISTA Certificate under ‘Other determinations’: “The germination method used is an in-house method validated by comparison with an ISTA standard method”, and the test conditions would be specified.

Making this “flexibility” proposal, with view to validated ISTA methods, it was disregarded that, according to the ECOM decision, PBA testing was permitted exclusively for GMO determination as an interim solution. Furthermore, the enormous expenditure of monitoring was not taken into account. Moreover, validation using only three samples in only three neighbouring laboratories is statistically no basis at all for a method to be considered valid in the sense of ISTA. In addition, in-house methods may even be not disclosed or not free for anybody’s use. Besides, testing against ISTA standard methods implies

that work in the TCOMs goes on as usual. But who will continue work in the TCOMs when optional in-house methods could be used arbitrarily? Well, there are national rules and there are rules for defined markets using other methods than ISTA does, and somewhere or other even in-house methods may be permissible.

There is no need for discussion of the validity and usefulness of in-house methods. In fact, there is only the obligation to emphasise the ISTA mission: “Our Association produces internationally agreed rules for seed sampling and testing” and the ISTA vision “Uniformity in seed quality evaluation worldwide” (ISTA 2013). “Flexibility” is just the opposite of ISTA’s mission and vision.

The stakeholders of ISTA, i.e. the partners in international trade and the authorities, know about the validity of the information documented on ISTA Certificates issued in accordance with the ISTA Rules by ISTA-accredited laboratories. This has formed the self-understanding, reputation and power of ISTA for more than 80 years since the first Rules were introduced. It is not difficult to imagine that the reporting of data obtained by arbitrarily using optional in-house methods is hardly fitting in the conception of the stakeholders. ISTA has gone a long way in striving for uniformity in seed testing. “Flexibility” was the situation in Nobbe’s day. At present, there are 124 ISTA-accredited Member Laboratories. How about 124 different in-house methods for the one and the same germination determination?

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30th ISTA Congress Antalya, Turkey, 12–18 June 2013

Overview

Tue–Thur 4–6 June ISTA Vigour Workshop, İzmir (see page 59)

Thur–Sun 6–9 June ISTA Workshop on Purity and Germination, Ankara (see page 60)

Tuesday 11 June Welcome reception

Wednesday 12 June Opening ceremony

Wed–Fri 12–14 June ISTA Seed Symposium (see page 38)

Friday 14 June Official Dinner

Sat–Mon 15–17 June Presentation of ISTA's technical work (see page 32)

Monday 17 June Discussion on ISTA strategy 2013–2016 Discussion Forums

Tuesday 18 June ISTA Ordinary General Meeting with election of Executive Committee (see page 32)

Wed–Fri 19–21 June Post-Congress tours to İstanbul, İzmir, Kapadokya and Antalya (see page 37)



Final programme

Venue: Kervansaray Hotel Lara, Antalya

All activities mentioned in the programme will be held at the Congress venue (Kervansaray Lara Hotel)

| | | | |
|--------------------------------|---|-------------------------------|--|
| Tuesday, 11 June 2013 | | 12:30–13:30 | Lunch break |
| 12:00–19:00 | Congress Registration desk open | 13:30–14:30 | Session 1 (continued) |
| 18:30–21:00 | Congress Welcome reception | Paper 4 | Determination of the optimum blowing point for <i>Paspalum vaginatum</i> Stanley Baker and Sabry Elias, Oregon State University, United States |
| Wednesday, 12 June 2013 | | Paper 5 | Varietal characterization of chickpea (<i>Cicer arietinum</i>) varieties R Ankaiah, A Lalitha, KV Radha Krishna, B Rajeswari and K Kanaka Durga, Ang Ranga Agricultural University, India |
| 08:00–17:00 | Congress Registration desk open | Paper 6 | Study on time duration of viability and related infestation possibility of common bunt (<i>Tilletia caries</i>) and dwarf bunt (<i>T. controversa</i>) spores of wheat in soil and farmyard manure taking into account different crop rotation systems in ecological farming Robert Bauer, Benno Voit, Berta Killermann and Kurt-Jürgen Hülsbergen, Bayerische Landesanstalt für Landwirtschaft, Germany |
| 08:30–17:00 | ISTA Seed Symposium day 1 | | |
| 08:30–09:30 | Opening ceremony | | |
| | – Welcome by the Minister or Undersecretary of Ministry of Food, Agriculture and Livestock (MFAL) | | |
| | – Welcome by the Chair of the National Organising Committee (NOC) | | |
| | – Welcome by the ISTA President | | |
| | Presentation: The seed industry in Turkey | | |
| 10:00–10:30 | Coffee break | 14:30–15:00 | Poster session 1 Chair: Hülya İbri, Ege University, İzmir, Turkey |
| 10:30–11:00 | ISTA Seed Symposium 2013: Evaluation of seed quality: a key step in exploiting the benefits of plant breeding and genetic conservation | 15:00–15:30 | Coffee break |
| | Symposium Convenor: Dr. Alison Powell, University of Aberdeen, United Kingdom | 15:30–17:00 | Poster session 1 (continued) |
| 11:00–12:30 | Session 1: Role of quality evaluation in seed production | Thursday, 13 June 2013 | |
| Keynote paper | Chair and Lead Speaker: Francisco Krzyzanowski, EMBRAPA Soja, Brazil | 08:00–16:30 | Congress Registration desk open |
| | The role of quality evaluation in seed production as exemplified by soybean seed production | 08:30–16:30 | ISTA Seed Symposium day 2 |
| Paper 1 | What affects the production of true seeds in perennial ryegrass? Birte Boelt, Aarhus University, Denmark | 08:30–10:00 | Session 2: Seed storage for commercial use and genetic conservation |
| Paper 2 | Flower production, seed yield and seed quality of <i>Allium cepa</i> var. <i>ascalonicum</i> L. as affected by BAP, boron and insect pollinators in the tropical highland and lowland Endah Retno Palupi, Rini Rosliani and Yusdar Hilman, Bogor Agricultural University, Indonesia | Keynote paper | Chair and Lead Speaker: Robin Probert, Millennium Seed Bank, RBG Kew, United Kingdom |
| Paper 3 | Caryopsis extraction from big bluestem spikelets (<i>Andropogon gerardii</i> Vitman) with seed conditioning equipment: Optimal water activity to achieve high seed quality Suleyman Kavak and Alan G. Taylor, Suleyman Demirel University, Turkey | Paper 1 | Pre-storage factors critically affect the quality of seeds for storage and use: a review of the underlying biology and practical implications |
| | | | Drying rice seeds to gene bank moisture contents using zeolite seed drying beads Fiona R. Hay and S. Timple, International Rice Research Institute, the Philippines |

- Paper 2 **Comparative study on ultra-drying methods of shallot (*Allium tuberosum*) seeds**
Shuchun Meng, Ling Liu, Xiuqing Li and Lianping Ma Beijing, Academy of Agriculture and Forestry Sciences, China
- Paper 3 **Different conditions for seed storage and orchid conservation**
Mariane M. Hengling, Leandro W. Sawamura, Silvério T. Hosomi, Ceci C. Custódio and Nelson B. Machado-Neto, UNOESTE, Brazil
- 10:00–10:30 Coffee break
- 10:30–11:30 **Session 2 (continued)**
- Paper 4 **Effects of temperature, relative humidity and moisture content on seed longevity of shrubby Russian thistle *Salsola vermiculata***
Abdoul Aziz Niane, Paul Christian Struik and Zewdie Bishaw, ICARDA, Morocco
- Paper 5 **Effect of seed storage on germination, seedling growth and survival of *Mimosa foliolosa* (Fabaceae): implications for restoration ecology of the threatened rupestrian grasslands**
Fernando Silveira, Daniel Negreiros, Bernardo Ranieri, Celice Silva and Luzia Araújo, Universidade Federal de Minas Gerais, Brazil
- Paper 6 **Molecular mapping and physiology of seed longevity in relation to seed coat colour of common bean**
Manuela Nagel, Vivien Scheibal, Frank Marthe, Paul Gepts and Andreas Börner, IPK Gatersleben, Germany
- 11:30–12:30 **Poster session 2**
Chair: Hülya İlbi, Ege University, İzmir, Turkey
- 12:30–13:30 Lunch break
- 13:30–14:30 **Poster session 2 (continued)**
- 14:30–15:00 **Session 3 (ISSS collaborative session): Physiological, biochemical and molecular markers of seed quality**
- Keynote paper Chair and Lead Speaker: Françoise Corbineau, Université Pierre et Marie Curie-Paris 6, Paris, France
Markers of seed quality: from a physiological to a molecular approach
- 15:00–15:30 Coffee break
- 15:30–16:30 **Session 3 (continued)**
- Paper 1 **Genetic dissection of seed longevity and dormancy by applying new molecular marker technologies**
Andreas Börner, Manuela Nagel, Mian Abdur Rehman Arif, Boris Kobijlski and Kerstin Neumann, Leibnitz Institute of Plant Genetics and Crop Plant Research, Germany
- Paper 2 **Seed storage in polyethylene bags of a recalcitrant species (*Quercus ilex*): analysis of some bio-energetic and oxidative parameters**
Sergio Pasquini, Michela Mizzau, Elisa Petrusa, Enrico Braidot and Sonia Patui, National Centre for the Study and the Conservation of the Forestry Biodiversity, Italy
- Paper 3 **Physiological, biochemical and molecular changes due to seed priming in cucumber (*Cucumis sativus* L.)**
KJ Sowmya, Rame Gowda Ramegowda, K. Bhanuprakash, H.S. Yogeasha, and T.B. Puttaraju, University of Agricultural Sciences, Bangalore, India
- Friday, 14 June 2013
- 08:00–17:00 Congress Registration desk open
- 08:30–17:00 **ISTA Seed Symposium day 3**
- 08:30–09:30 **Session 3 (continued)**
- Paper 4 **Seed germination and proteome analysis of primed and non-primed seeds of tall wheat grass (*Agropyron elongatum* (Host.) under low temperature and water deficit conditions**
Ali Moradi, Reza Tavakkol Afshari; Farzad Sharif Zadeh, Amir Moali and Christine Finnie, University of Tehran, Iran
- Paper 5 **Ageing and repair provide a physiological explanation for seed quality differences in oilseed rape revealed in the laboratory and the field**
Stan Matthews, Marie-Hélène Wagner, Linda Kerr, Gillian McLaren and Alison A. Powell, University of Aberdeen, United Kingdom
- Paper 6 **Cell cycle in high and low vigour maize (*Zea mays*) seeds and its relation with rate of germination**
Mohammad Khajeh-Hosseini, Behnaz Azimi and Saeed Malekzadeh, Ferdowsi University of Mashhad, Iran
- 09:30–10:00 **Session 4: Advanced methods in seed quality evaluation**
- Keynote paper Chair and Lead Speaker: Beni Kaufman, Pioneer, USA
Next generation seed quality testing
- Paper 1 **SpectraSeed: Seed phenotype database through spectral imaging**
Jens Michael Carstensen, Karsten Hartelius and Kaare Jensen, Videometer A/S, Denmark
- Paper 2 **Seed identification of medicinal plant species using machine vision**
Sepideh Anvarkhah, Mohammad Khajeh-Hosseini, Ali Davari Edalat Panah and Mohammad Hassan Rashed Mohassel, Ferdowsi University of Mashhad, Iran

Paper 3 **Development of a diagnostic tool and resource for seed identification with Lucid and imaging technologies**
Ruojing Wang and Jennifer Neudorf, Canadian Food Inspection Agency, Canada

10:00–10:30 Coffee break

10:30–12:30 **Session 4 (continued)**

Paper 4 **An image analysis for determination of genetic purity of different wheat varieties**
Esmail Nasrollahi Azar, Ghasem Tohidloo, Samad Mobasser, Majid Dehghan Shoar and Fardin Khazaei, Karaj Branch, Islamic Azad University, Iran

Paper 5 **Speed of seed imbibition related to seedling evaluation: precocious criteria from image analysis to predict the seedling type in a germination test**
Marie-Hélène Wagner, Sylvie Ducournau, Valérie Blouin, Didier Demilly and Joël Léchappé, GEVES-Station Nationale d'Essais de Semences, France

Paper 6 **Multiplex detection of plant pathogens**
Jan J.H.W. Bergervoet, Marjanne M. de Weerd, René R.A.A. van der Vlugt, Sharon S. Van Brunshot and José J.R.C.M. van Beckhoven, Plant Research International, the Netherlands

12:30–13:30 Lunch break

13:30–15:00 **Session 5: Evaluation and improvement of physiological quality**

Keynote paper Chair and Lead Speaker: Alison Powell, University of Aberdeen, United Kingdom
Electrical conductivity measurements of solute leakage: past and current use and their future application for rapid assessment of germination and vigour

Paper 1 **A method to prevent blindness in kohlrabi**
Fernando D. Goffman and Jennifer de Jonge, Enza Zaden Seed Operations B.V, the Netherlands

Paper 2 **Improved germination performance of aged maize seed in the presence of cathodic water**
David Mycock, Norman Pammenter and Patricia Berjak, University of the Witwatersrand, South Africa

Paper 3 **Chlorophyll fluorescence sorting method to improve quality of differently matured pepper seed lots**
Burcu Begum Kenanoglu, Ibrahim Demir and Henk Jalink, Çanakkale Onsekiz Mart University Bayramiç Vocational High School, Turkey

15:00–15:30 Coffee break

15:30–16:30 **Session 5 (continued)**

Paper 4 **Lentil germination evaluation: comparison of seed testing methods for testing uniformity among laboratories**
Ruojing Wang, Leanne Duncan and Janine Maruschak, Canadian Food Inspection Agency, Canada

Paper 5 **Why tetrazolium chloride does not enter intact seeds during imbibition**
Alan Taylor and Sarah Pollicove, Cornell University, United States

Paper 6 **Speeding up the controlled deterioration (CD) test for *Brassica* spp.**
Sebastian Bopper and Michael Kruse, University of Hohenheim, Germany

16:30–17:00 **Overview of Symposium**
Ibrahim Demir, University of Ankara, Turkey
Conclusion of Symposium
Alison Powell, University of Aberdeen, United Kingdom

19:00–23:00 **Official Congress Dinner and Presentation of Seed Symposium Awards**

Saturday, 15 June 2013

08:00–17:00 Congress Registration desk open

09:00–18:00 **Presentations of ISTA's technical work and meetings of ISTA Technical Committees**

09:00–10:00 Bulking and Sampling Committee
Chair: Leena Pietilä

10:00–10:30 Coffee break

10:30–11:00 Flower Seed Committee
Chair: Rita Zecchinelli

11:00–11:30 Forest Tree & Shrub Seed Committee
Chair: Fabio Gorian

11:30–12:30 Germination Committee
Chair: Sylvie Ducournau

12:30–13:30 Lunch break

13:30–14:00 Moisture Committee
Chair: Craig McGill

14:00–14:30 Variety Committee
Chair: Berta Killermann

14:30–15:30 Statistics Committee
Chair: Jean-Louis Laffont

15:30–16:00 Coffee break

16:00–17:00 GMO Committee
Chair: Cheryl Dollard

17:00–17:30 Nomenclature Committee
Chair: John Wiersema

17:30–18:00 SST Editorial Board
Chair: Fiona Hay

Sunday, 16 June 2013

08:45–17:30 Presentations of ISTA's technical work and meetings of ISTA Technical Committees (continued)

- 08:45–09:30 Purity Committee
Chair: Adriel Garay
- 09:30–10:30 Seed Health Committee
Chair: Terry Aveling
- 10:30–11:00 Coffee break
- 11:00–11:30 Seed Storage Committee
Chair: Hugh Pritchard
- 11:30–12:30 Tetrazolium Committee
Chair: Stefanie Krämer
- 12:30–13:30 Lunch break
- 13:30–14:00 Seed Vigour Committee
Chair: Alison Powell
- 14:00–14:30 Advanced Technologies Committee
Chair: Bert van Duijn
- 14:30–15:00 Rules Committee
Chair: Steve Jones
- 15:00–15:30 Coffee break
- 15:30–17:30 Rules Committee (continued)
Chair: Steve Jones

Monday, 17 June 2013

08:45–17:30 Presentations of ISTA's technical work and meetings of ISTA Technical Committees (continued)

- 08:45–09:30 Proficiency Test Committee
Chair: Günter Müller
- 09:30–10:30 Laboratory Accreditation and Quality Assurance Programme
Chair: Rasha El-Khadem
- 10:30–11:00 Coffee break
- 11:00–11:30 **Discussion on the Accreditation Review**
Chair: Rita Zecchinelli
- 11:30–12:30 **Discussion Forum:**
Do the current principles and requirements for the ISTA Rules meet with the future needs for developments in seed technology?
Chair: Steve Jones and Craig McGill
- What is currently required for validation and proposals for the ISTA Rules?**
Steve Jones
- Why would you want to add something to the ISTA Rules?**
Craig McGill

What are potential new developments that might be considered for validation and the ISTA Rules?

Alison Powell

Questions and discussion

12:30–13:30 Lunch break

13:30–14:30 **Discussion Forum:**

Discussion on the use and international standardization of DNA technologies in the area of seeds

Chair: Berta Killermann and Cheryl Dollard

Overview of DNA technologies – current uses and applications

Questions and discussion

Required elements of international standardization

Questions and discussion

Use of Internationally standardized DNA technologies in seed certification/variety registration

Questions and discussion

14:30–15:00 Discussion on the use of the Financial Tool

Chair: Steve Jones

15:00–15:30 Coffee break

15:30–17:30 Discussion on the Draft ISTA Strategy 2013–2016

Chair: Joël Léchappé and Secretary General

Tuesday, 18 June 2013

08:30–17:30 ISTA Ordinary General Meeting

08:30–08:45 Welcome by the ISTA President, Joël Léchappé

- 08:45–10:00
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 (including review of accreditation and use of the financial tool)
 6. Report of the Secretary General

10:00–10:30 Coffee break

- 10:30–12:30
7. ISTA Strategy 2013–2016
 8. Election of Officers and members-at-large of the Executive Committee
 9. Fixation of annual subscriptions

12:30–13:30 Lunch break

| | | | |
|-------------|--|-------------|--|
| 13:30–15:30 | <ul style="list-style-type: none"> 10. Consideration and adoption of the proposed changes to the ISTA Articles 11. Consideration and adoption of the proposed Rules changes 12. Consideration and adoption of reports 13. Announcement of the place and date of the next Ordinary General Meetings 14. 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 15. Any other business raised by consent of the Executive Committee | 15:30–16:00 | Coffee break |
| | | 16:00–17:30 | <ul style="list-style-type: none"> 16. Discharge of the Executive Committee 17. Installation of new Officers and Executive Committee members 18. President's closing address 19. Adjournment |

Changes to the *International Rules for Seed Testing* 2014 Edition

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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 11.

For the 2014 Edition, a large number of changes to species names will be proposed following the update to the ISTA Stabilized List, which takes place every six years. These changes will affect primarily Tables 2A, 3B and 5A. They are taken from the document OGM13-05A “Proposed Changes to the ISTA List of Stabilized Plant Names”, for voting at the ISTA Ordinary General Meeting 2013.

Among the proposed changes are the following:

Chapter 1: Certificates

- Amendments to “Reporting results” following changes to Chapters 11 and 18, and new Chapter 19

Chapter 2: Sampling

- Changes to species names
- Storage of samples after testing
- Changes to the minimum submitted sample sizes of coated seeds

Chapter 3: The Purity Analysis

- Adding the use of an anemometer for the uniform blowing method

Chapter 5: The Germination Test

- Harmonisation between ISTA Rules and ISTA Handbook on Seedling Evaluation in respect to the evaluation of the cotyledons (50% rule)
- Shortening the duration of germination test for certain grass species

Annex to Chapter 7: Seed Health Testing Methods

- Editorial corrections to several methods, following reviews
- Addition of positive controls in all methods
- Modifications to seed health methods 7-019b, 7-021 and 7-028

- New seed health method 7-029: Detection of *Pseudomonas syringae* pv. *pisi* on *Pisum sativum* (Pea) seed
- New seed health method 7-007: Detection of *Alternaria linicola*, *Botrytis cinerea* and *Colletotrichum lini* on *Linum usitatissimum* (Flax) seed. This method would combine and replace existing methods 7-007, 17 and 18.

Chapter 8: Species and Variety Testing

- Complete review of Chapter 8
- New improved A-PAGE method for the verification of *Triticum*
- New SDS-PAGE method for the verification of *Triticum* and \times *Triticosecale* varieties

Chapter 11: Testing Coated Seeds

- Testing methods and reporting for the tetrazolium test for coated seeds

Chapter 18: Seed Mixtures

- Testing methods and reporting for the tetrazolium test for seed mixtures

Chapter 19: Testing for Seeds of Genetically Modified Organisms

- New Chapter for the ISTA Rules

General information on Turkey and Antalya

Turkey, exotic, colourful, many-faceted, romantic, ever old and ever new, is the gateway to the fabled east. Turkey is a country located at a point where the three continents of the old world, Asia, Africa and Europe, are closest to each other, and where Asia and Europe meet. Because of its geographical location, Anatolia has always been important throughout history and is the birthplace of many great civilizations. Turkey is not only a corridor through which the ancient Asian Turkish culture is transmitted to Europe, but is also regarded as a window of Western culture opening to meet Eastern culture.

Climate

The Mediterranean and Aegean shores of Turkey experience long, hot summers and mild, rainy winters. Istanbul averages 0 °C (32 °F) in January and 23 °C (73 °F) in July. Average annual precipitation totals 697 mm (27.4 in.), most of which falls in December and January. Along the central Anatolian plateau, a continental climate prevails, with hot summers and colder winters. The plateau receives only about half as much precipitation, but it is more evenly distributed throughout the year. The eastern highlands experience even longer and colder winters. Along the Black Sea, the



Map of Turkey, showing Congress and workshop venues.

climate is mild and rainy. Southeast Anatolia records the country's highest summer temperatures, averaging more than 30 °C (86 °F) in July and August.

About Antalya

Antalya is also known as “the paradise on earth”, “the pearl of the Mediterranean”, and “the Turkish Riviera”.

It is the location of the most magnificent and best preserved ancient theatre in Asia and Africa, the Aspendos Theatre.

In addition to numerous archaeological cities and historic buildings, Antalya offers lots of waterfalls, caves and an endless beach.

According to a worldwide survey of customer satisfaction, conducted among 35 million people, 15 of the world's top 100 hotels are in Antalya.

The world-class golf clubs of Antalya are among the favourites of internationally famous golfers.

The city was visited by Attalos, and subsequently by queens and emperors such as Cleopatra and Hadrian.

Thanks to the ancient statues on display, Antalya Museum is one of the world's most important museums.

The turquoise shores of Antalya combine ancient cities whispering tales of history, myth and legend, met on either side by tranquil, emerald-green forests and the sparkling waters of the Mediterranean. This is the perfect choice for a vacation surrounded by sea, sun, sand and more. Along with a cultural heritage deeply rooted in history, Antalya's coves and highlands of unique beauty, pristine beaches, comfortable hotels and marinas, colourful entertainment venues, and art-filled festivals all make it a tourist destination that offers its guests endless possibilities. These include the pleasure of sunbathing from sunrise to sunset; the natural thrill of outdoor sports in the grip of mother nature; the excitement of discovering national parks with their rich flora and fauna, ancient cities, and museums; the mystery of the mountains and the peaceful Mediterranean coves drawing you away; the romance of watching an opera outdoors under the

Registration fees (online registration at www.seedtest.org/2013)

| Periods | Events | Registration fee |
|------------------------------------|----------------------------------|------------------|
| ISTA Members | | |
| 12-18 June | Congress incl. Symposium | 590 € |
| 12-17 June | Symposium & TCOM meetings only | 540 € |
| Non-members | | |
| 12-18 June | Congress incl. Symposium | 970 € |
| 12-17 June | Symposium & TCOM meetings only | 880 € |
| Students | | |
| 12-17 June | Symposium & TCOM meetings only | 175 € |
| Accompanying persons | | |
| 12-18 June | Social events, lunches etc. only | 300 € |
| Exhibitors (incl. 1 person) | | |
| 12-18 June | Exhibition booth | 3000 € |

stars at night; sampling the unique delicacies of Turkish cuisine and enjoying the party scene. Meeting the hospitable people of Antalya is just another part of the pleasant holiday experience.

In June, average air temperatures in Antalya are 30–35 °C, and average sea temperatures 25–30 °C.

Flight information

Flight time from Istanbul to Antalya is 1 hour, with direct flights offered by Turkish Airlines and other domestic carriers. In June, many direct charter flights are available from most major European cities. Turkish Airlines also offers easy connections to all passengers arriving in Istanbul from its other direct flight locations with Turkish Airlines or other Star Alliance Members. From the airport to the ISTA Congress venue, the Kervansaray Hotel Lara, the taxi fare is approximately 20 €/40 Turkish lira.

There are direct flights to and from Aalborg, Amsterdam, Astana, Baghdad, Basel/Mulhouse, Berlin, Bournemouth, Bremen, Brussels, Chelyabinsk, Cologne, Copenhagen, Donetsk, Dortmund, Dresden, Düsseldorf, Eindhoven, Ekaterinburg, Frankfurt, Glasgow, Göteborg, Hamburg, Hanover, Helsinki, Karaganda, Kemerovo, Kiev, Liege, L'viv, Malmö, Manchester, Minsk, Munich, Newcastle, Nuremberg, Orenburg, Oslo, St Petersburg, Sarajevo, Stuttgart, Tel Aviv, Vienna, Warsaw and Zurich.

Visas

All participants are advised to check with the Turkish Consular Missions (where available) for visa requirements. Please check the Ministry of Foreign Affairs web site about details of visa requirements (www.mfa.gov.tr/visa-information-for-foreigners.en.mfa). A letter of invitation can be issued by the ISTA Secretariat to registered participants requiring a visa.

Medical facilities

In addition to the special precautions taken by the host authorities, medical facilities available at the Hotel Kervansaray Lara will be at the disposal of the participants. In case of need, please contact the relevant information desks.

Local time

Local time in Istanbul is UTC/GMT + 2 hours.

Working hours

Banks are open Monday to Friday from 08:30 until 12:00 or 12.30, depending on the bank, and from 13:30 until 17:00. However, some banks continue to serve during lunch breaks.

Museums are generally open from Tuesday to Sunday from 9:30 until 17:00 or 17.30, and closed on Monday. Shops and bazaars are normally open from Monday to Saturday from 9:30 to 22:00, and closed all day on Sundays. However, shopping malls and stores on main streets are open all day, seven days a week. You can find restaurants or cafes open at virtually any time of the day or night.

Official institutions and banks are closed on Saturday and Sunday.

Currency and foreign exchange

On 1 January 2009, the monetary unit in Turkey was changed to the Turkish lira (TL or TRY), which comes in bank notes of 5, 10, 20, 50, 100 and 200 TL. Smaller denominations come in coins of 1 TL and 50, 25, 10, 5 and 1 kuruş (kr.). 1 lira equals 100 kuruş. The exchange rates are around 1 US dollar = 1.82 TL, and 1 euro = 2.35 TL.

The most recent exchange rate values may be accessed at the web site of the Central Bank of the Republic of Turkey (www.tcmb.gov.tr/yeni/eng).

Convertible foreign currency can be exchanged at the airport, hotels and exchange offices, as well as at all banks, in accordance with the daily announced exchange rates.

In Turkey, travellers' checks are rarely accepted. We recommend that you cash your travellers' checks at the banks.

ATMs can be found in even the smallest Turkish towns. Most accept international credit cards or bank cards (a strip of logos is usually displayed above the ATM). Almost all ATMs have a language key to enable you to read the instructions in English.

Value-added tax

Value-added tax (VAT), in Turkey called KDV, is 18%. VAT is usually included in quoted prices. Certain shops are authorized to refund the tax.

Credit cards

International credit cards are widely used. Major credit cards (American Express, Visa, Diner's Club, MasterCard, Access, JCB, Eurocard etc.) are accepted in most establishments. Most ATMs accept international credit or bank cards.

Electricity supply

The electrical current in Turkey is 220 volts, 50 cycles alternating current (AC). Wall outlets take Continental-style plugs with two round prongs.

Communication

Turkey has a highly sophisticated communication system. In addition to the usual postal and telephone services, GSM telephones can be used through international roaming agreements. Please contact your GSM operator for more information. It is possible to use most cellular phones in Turkey.

30th ISTA Congress, Antalya, Turkey, 12–18 June 2013
Online registration now open: www.seedtest.org/2013



Public telephones have two different systems. Some of them work with cards while others work with tokens. Cards and tokens are both sold in post offices and tobacco shops. For international calls it is advisable to purchase cards.

All over Turkey, phone numbers consist of two sections: the 3-digit area code, and the 7-digit number. Calls within an area require only the 7-digit number. Calls to a different require 0 + area code + 7-digit number. International calls require 00 + country code + area code + number.

Accommodation

*All prices include VAT.

Kervansaray Hotel Lara ★★★★★ (Congress venue)

Location: Lara
Single room: 129.00 €
Double room: 175.00 €

Kervansaray Hotel Kundu ★★★★★

Location: Kundu
Single room: 129.00 €
Double room: 175.00 €

Titanic Beach Resort Hotel ★★★★★

Location: Lara
Single room: 175.00 €
Double room: 235.00 €

Miracle Hotel ★★★★★

Location: Lara
Single room: 180.00 €
Double room: 240.00 €

Falez Hotel ★★★★★

Location: Konyaalti
Single room: 80.00 €
Double room: 130.00 €

Lara Hotel ★★★★★

Location: Lara
Single room: 60.00 €
Double room: 80.00 €

Bilem Hotel (boutique hotel)

Location: Lara
Single room: 60.00 €
Double room: 80.00 €

Congress venue: Kervansaray Hotel Lara Convention Center and Spa

With its post-modern design and a glass facade covering 65 000 m², the Kervansaray Lara Hotel Convention Center and Spa stands in 110 000 m² of grounds on the heavenly Lara Beach.

The hotel's 3309 m² convention center consists of an auditorium for 2000 people, 15 different meeting halls, a 1425 m² lobby and the latest technological facilities, offering an excellent service for both vacations and meetings. The Kervansaray Hotel Lara is 10 km from Antalya International Airport, and it is the venue of the 30th ISTA Congress 2013.

Contact:

Lara Turizm Merkezi Antalya Türkiye
+90 242 352 20 00
+90 242 352 20 32
www.kervansarayhotels.com.tr

Social programme

Post-Congress tours (19–21 June 2013)

Istanbul (2 nights, 3 days tour)
İzmir (2 nights, 3 days tour)
Kapadokya (2 nights, 3 days tour)
Antalya (2 nights, 3 days tour)

Tour prices:

16 March–15 May 2013: 900 €
For details, see <http://ista2013antalya.org/social.php>

Accompanying persons programme (12, 14, 16 June)

12 June: Perge – Aspendos – Düden tour with boat trip

09:30 Departure from the Hotel
10:00–13:00 Perge – Aspendos – Düden
13:30–18:30 Boat trip with lunch
19:30: Return to Hotel

14 June: Side – Manavgat tour

09:30: Departure from the Hotel
11:00–12:30: Kemer
13:00–14:30: Lunch
15:00–18:00: Side – Manavgat
19:30: Return to Hotel

16 June: Alanya tour with boat trip

09:30: Departure from the Hotel
11:30–13:30: Alanya
14:00–18:00: Boat trip with lunch
20:00: Return to Hotel

Tour prices:

Bookings up to 15 March 2013: 75 €
Bookings 16 March–15 May 2013: 90 €
VAT is included in all prices.

Cancellations

Between 15 March and 30 April 30, 2013: 50% refund (excluding bank charges).
After 30 April 2013: no refund.
All refunds will be made after the Congress.

To book any of the above tours, please contact:

Flap Tour
441. CADDE No: 1
06610 Birlik-Çankaya – Ankara
Turkey
Phone: (+90) 312 454 0000
Fax: (+90) 312 454 0001
Web: www.flaptour.com.tr
Mail: ista2013antalya@flaptour.com.tr

30th ISTA Congress, Antalya, Turkey, 12–18 June 2013
Online registration now open: www.seedtest.org/2013

How to become a Member of the ISTA Executive Committee

Michael Muschick
Former ISTA Secretary General

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The ISTA Executive Committee members have a high responsibility towards the ISTA Membership regarding the future development of the Association. The concrete tasks of the Executive Committee are laid down in ISTA Article 15.

The Executive Committee holds personal meetings three times a year: two meetings in conjunction with the ISTA Annual Meeting or Congress, and a three-day business meeting at the beginning of the year.

The Executive Committee consists of the President, the Vice-President, and nine Members-at-Large.

If you wish to become a member of the Executive Committee, you need:

- to become a Personal Member of the Association;
- to be nominated by your Government to represent this government in the affairs of ISTA – meaning that you need to become a ‘Designated Member’;
- to be nominated as candidate for the Executive Committee during the ISTA Congress;
- to be elected by the ISTA Ordinary General Meeting as a member of the Executive Committee.

How to become a Personal Member

If you wish to become a Personal Member, you have to apply for personal membership through the ISTA Secretariat.

The Secretariat will send you the appropriate application documents. The Executive Committee decides on your application to become a Personal Member.

How to become a Designated Member

Designated Members are Personal Members who have been nominated by their Government to represent the Government in the affairs of ISTA.

The ISTA Secretariat can provide the Personal Member with the address of the relevant governmental authority (= Designated Authority) in their country which has the authority to designate Personal Members as Designated Members. The designation process for becoming a Designated Member is a country-specific procedure in which ISTA bodies are not involved.

How to become nominated as candidate for the Executive Committee

Any Designated Member can become a candidate for the Executive Committee or the position of the Vice-President through nomination by two other Designated Members, neither of whom needs to be from the same country or distinct economy as the candidate.

At the beginning of each ISTA Congress, application forms for the nomination of candidates for the Executive Committee and the Vice-President are available at the booth of the ISTA Secretariat.

The name of the candidate and their personal ISTA code (e.g. XXDM01) must be stated on the application form, together with the names and personal ISTA codes of two other Designated Members from the same or from a different country or distinct economy who are supporting the candidate.

The application form is only valid with these names and codes. Designated Members can be identified by the corresponding indications on their name tags.

The completed application forms must be returned to the booth of the ISTA Secretariat at the latest by the day before the

Ordinary General Meeting, as will be announced during the Congress.

How to become a member of the Executive Committee

The ISTA Secretariat will check the validity of the application forms received, and from the list of valid applications will form a list of candidates for the Executive Committee and the position of the Vice-President.

This list will be presented to the Voting Delegates and Members at the Congress, before the Ordinary General Meeting.

Candidates will have time to introduce themselves during the Ordinary General Meeting.

After this introduction of the candidates, the election process takes place. The identified Voting Delegates will receive, together with their voting documents, two voting sheets: one for the Vice-President, and one for the nine Members-at-Large.

First, the election of the Vice-President takes place. Voting Delegates must enter the name of their preferred candidate for this position on their voting sheets. The Vice-President is elected by a simple majority.

After the election of the Vice-President, all other candidates are automatically placed on the list of candidates for Members-at-Large. From this list, Voting Delegates may choose eight names to enter on their voting sheets (the ninth place being reserved for the representative of the government hosting the next ISTA Congress). The eight candidates with the highest numbers of votes are elected as members of the Executive Committee.

The newly elected Executive Committee is installed at the end of the Ordinary General Meeting, and holds its constitutive meeting on the day directly after the Ordinary General Meeting. ■

Preparatory documents for the Ordinary Meeting

The following documents are submitted to the ISTA Ordinary General Meeting 2013 for information and discussion and/or acceptance by the nominated ISTA Designated Members voting on behalf of their respective Governments:

- OGM13-01 Agenda for the Ordinary Meeting 2013 [information document]
- OGM13-02 Minutes of the Ordinary Meeting 2012 [information document]
- OGM13-03 Activity Report of the ISTA Committees 2012 [voting document]
- OGM13-04 Proposal for the Membership Fees 2014 [voting document]
- OGM13-05 Rules Proposals for the International Rules for Seed Testing 2014 Edition [voting document]
- OGM13-05A Proposed Changes to the ISTA List of Stabilized Plant Names [voting document]
- OGM13-06 Method Validation Reports on Rules Proposals for the International Rules for Seed Testing 2014 Edition [supporting document to voting document OGM13-05]
- OGM13-07 Article Change Proposals 2013 [voting document]
- OGM13-08 Proposed Changes to the Rules of Order for Ordinary Meetings [voting document]
- OGM13-09 ISTA Strategy 2013–2016 [voting document]

Please note that only a very limited number of 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/OGM13.

Proposed changes to the Rules of Order for Ordinary Meetings

These changes are being proposed so the Rules of Order of ISTA meetings are consistent with *The Articles of the International Seed Testing Association*.

The full document “OGM13-08 Proposed changes to the Rules of Order for Ordinary Meetings” was sent to the Members in April, two months before the OGM.

The proposed changes to the Rules of Order are:

- the phrase “ISTA Constitution” is replaced by the phrase “ISTA Articles” or “Articles of the International Seed Testing Association”;
- the phrase “Ordinary Meeting” is replaced by the phrase “General Meeting”;
- the phrase “1st Vice-President” is replaced by “Vice-President”;
- editorial changes to §6 “Handling of motions”, point 3 (see opposite). ■

| Current | Proposed |
|--|---|
| <p>§ 6 Handling of motions</p> <p>3) When the debate appears to have closed, the President may ask 'Are you ready for the question' and is putting the question.</p> <p>If no one then rises to claim the floor, the President stated the question and is calling for a vote. The exact wording the President uses in putting the question is definitive, provided nobody claims erroneous putting of the question by the President before the vote.</p> | <p>§ 6 Handling of motions</p> <p>3) When the debate appears to have closed, the President may ask 'Are you ready for the question' and then puts the question.</p> <p>If no one then rises to claim the floor, the President restates the question and then calls for a vote. The exact wording the President uses in restating the question is definitive, provided nobody claims erroneous restating of the question by the President before the vote.</p> |

Proposals to change the Articles of ISTA

Following the adoption of the new Articles of ISTA at the Ordinary Meeting in 2012, a number of changes are being proposed for voting at the 2013 Ordinary General Meeting, in order to clarify certain points.

The full document “OGM13-07 Article Change Proposals 2013” was sent to the Members in April, two months before the OGM.

The proposed changes are summarized below.

Proposal OGM13-07-1: To require a two-thirds majority of those voting for motions that will result in a change to the Articles of ISTA to be adopted by the Ordinary General Meeting.

At the 2012 ISTA Ordinary General Meeting there was discussion on whether a motion that, if adopted, would require a change to the Articles of ISTA, needed a simple majority or a two-thirds majority of those voting to be adopted. This was not resolved at the 2012 Ordinary General Meeting. This Article Change proposal will clarify this by modifying (Article 12 (b)) so that a two-thirds majority of those voting is required for motions that will result in a change to the Articles of ISTA.

Proposal OGM13-07-2: To require a two-thirds majority of those voting to adopt a motion (resolution) to exclude a Member.

At the 2012 ISTA Ordinary General Meeting a new Article, Article 7 was adopted. This Article states “Any exclusion of Members requires a resolution by the Members and good cause.” This is a requirement for ISTA to be recognised as an association under the Swiss Circle code articles 60 ff. The exclusion of any Member from the Association is a serious decision. Under the current Articles this decision requires a simple majority. The ECOM is of the view that, because a motion to exclude a member invokes an article in the Articles of ISTA, any such motion should also require a two-thirds majority for adoption.

Proposal OGM13-07-3: To amend Article 11 (e) (10) so that notification in writing of any other business raised by a Member must be received by the Secretariat at least three months prior to the date of the General Meeting.

This proposal is to remove an inconsistency between the Articles of ISTA and the Rules of Order of the Ordinary Meeting, adopted at the 2007 ISTA Ordinary Meeting.

A three month notification period will give time for:

- motions to be checked against the Articles of ISTA to ensure that no concurrent change to the Articles of ISTA is required if the motion is adopted;
- preparing (formatting) the motion for distribution to Members and Designated Authorities at least two months prior to the General Meeting.

Proposal OGM13-07-4: To insert the heading “B. Officers and Executive Committee“ before Article 13.

This proposal inserts an omitted heading.

Proposal OGM13-07-5: To change the words “the Constitution“ to “these Articles“.

This proposal corrects incorrect references to the old name “Constitution”.

In Article 22, the term “Constitution” is correct, but needs to be complemented with the term “Articles”.

| Current | Proposed |
|--|---|
| Proposals OGM13-07-1 and OGM13-07-2 (two separate proposals) | |
| Article 12 Voting | Article 12 Voting |
| (a) ... (b) The following categories of motions require for adoption a two-thirds majority of those voting: (1) Motions to alter these Articles. (2) Motions to dissolve the Association. (3) Motions arising during General Meetings and relating to temporary adjournment, closing of debate, or postponement of action. All other motions require a simple majority of those voting for adoption. (c) ... | (a) ... (b) The following categories of motions require for adoption a two-thirds majority of those voting: (1) Motions to alter these Articles. (2) Motions that do not alter these Articles but will create a need to change these Articles. (3) Motions to dissolve the Association. (4) Motions arising during General Meetings and relating to temporary adjournment, closing of debate, or postponement of action. (5) Motions to exclude a member under the provisions of Article 7 of these Articles. All other motions require a simple majority of those voting for adoption. (c) ... |
| Proposal OGM13-07-3 | |
| Article 11 Meetings | Article 11 Meetings |
| ... (10) 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. | ... (10) Any other business raised by a Member, of which notice in writing has been received by the Secretary General at least three months prior to the date of the General Meeting. |

Continued on next page

In memory of Prof. Dr. Julianna Bányai († 22 January 2013)

Jean-Louis Laffont
Chair, ISTA Statistics Committee



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Dear ISTA Colleagues,

We are saddened to announce that on 22 January 2013, Dr. Julianna Bányai passed away peacefully at the age of 90.

Dr. Bányai's contributions to statistics had a great impact on our Association, and they still benefit us today.

She began her service to ISTA in 1974, and continued to make active contributions up to 1998 and beyond.

Dr. Bányai served for five three-year terms as Chair of the ISTA Statistics Committee. During this time, she organized the first three ISTA seminars on statistics. During Dr. Bányai's term of office she was instrumental in incorporating the R-test for heterogeneity testing of seed lots into

the ISTA Rules, in addition to the already approved H-test, which are still in use today. She also co-authored with Dr. Julia Barabas a Handbook on Statistics in Seed Testing.

During her tenure as Professor of Mathematics and Physics at the University of Sciences in Budapest, Hungary, she published over 80 papers, of which 60 were in the field of seed testing.

In 2010, for her contributions and service to our Association, Dr. Julianna Bányai was declared an Honorary Life Member of ISTA.

We hope that you will keep a lasting memory of this fine woman and her service to ISTA. ■



Continued from previous page

| Current | Proposed |
|----------------------------|--|
| Proposal OGM13-07-4 | |
| Article 13 Officers ... | B. Officers and Executive Committee Article 13 Officers ... |
| B. Auditors | C. Auditors |
| Article 17 Figures ... | Article 17 Figures ... |

| Current | Proposed |
|---|---|
| Proposal OGM13-07-5 | |
| Articles 4, 15, 20, 23 ... the Constitution ... | Articles 4, 15, 20, 23 ... these Articles ... |
| Article 22 Coming into Effect ... | Article 22 Coming into Effect ... |
| The Articles adopted as Constitution in previous meetings of the Association are therefore annulled once the Articles are signed. | The Articles adopted as Constitution or Articles in previous meetings of the Association are therefore annulled once the Articles are signed. |

ISTA GMO Working Group on Rules Chapter and Handbook Toulouse, France, 13–16 February 2013

René Mathis¹, Cheryl Dollard² and Enrico Noli³

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From February 13 through 15, 2013, a Working Group of the ISTA GMO Committee met in Aussonne near Toulouse (France) hosted at the premises of DuPont Pioneer Hi-bred to work on a Rule Chapter and a Handbook on GMO testing for seeds. The meeting was kindly organized by Jean-Louis Laffont (DuPont Pioneer), a very active member of the GMO Task Force and then Committee since the very beginning. The other participants were René Mathis (WG leader, GEVES, FR), Cheryl Dollard (ISTA GMO Technical Committee Chair, Canadian Food Inspection Agency, CA), Elizabeth Bates (Bayer BioScience NV, BE), Christoph Haldemann (Agroscope Liebefeld-Posieux Research Station ALP, CH), Benjamin Kaufman (DuPont Pioneer Hi-bred, US), Enrico Noli (University of Bologna, IT) and Bruno Zaccomer (Monsanto, FR).

Since the 2005 meeting held in Bangkok, GMO testing was included in the ISTA Rules as a section of Chapter 8 “Species and Variety Testing”. Differently from for any other types of testing described in the Rules, including variety testing, for the testing of biotechnological traits the category of “performance based methods” was created. In other words, the possibility was introduced for a laboratory to gain accreditation for methods evaluated, approved and implemented according to the principles laid down in a series of relevant ISTA documents. After several years, the success of ISTA in this field is proved by some facts: several member laboratories have gained accreditation for GMO testing, an outstanding and very successful Proficiency Test program has been installed, and a rather intensive didactic activity, with Workshops carried out in almost every part of the world, has been implemented.



Nevertheless with this experience, considering the distinctive features of GMO testing, at the 2011 meeting in Zurich it was decided to create in the ISTA Rules an independent Chapter addressing both adventitious presence and trait purity testing of GMOs. This choice was deemed necessary not only in relation to the peculiarities of the “performance based approach” (PBA), but also for the vast array of methods and of the possible approaches to testing that required to be dealt with separately.

Over the summer and fall the working group was very active, with many e-mail exchanges and a high frequency of phone conferences throughout the year. A first draft was then produced and, after TCOM review, sent to the ISTA Secretariat to be included in the Rules Proposals for consideration at the next meeting in Antalya. However, while preparing the draft it became clear that, even if as a separate Chapter, the text should be limited to illustrating the general principles and providing an overview of the processes, whereas the technical details had to be given in a Handbook. The meeting in Toulouse was carried out with the following objectives: to improve the draft of the Rule Chapter and to progress on the Handbook for GMO Testing.

During the three days, the collective reading of the documents was a perfect opportunity for very deep and fruitful discussions, allowing useful clarifications on many aspects of GMO testing. As a result, a new, revised version of the Chapter, significantly streamlined, was produced and sent to the ISTA Secretariat for inclusion in the Rules Proposals. Regarding the Handbook, the Table of Contents was defined. In particular, it will contain essential information concerning: generalities on GMOs, objective of testing, available technologies, guidelines for setting up laboratories, statistical tools for test planning and analysis of results, method validation and evaluation of laboratory performance under the PBA, laboratory auditing. Moreover the Handbook will collect and organize the several basic ISTA documents on GMO testing, currently independent. The first bricks for the construction of the Handbook were set, although a lot remains to be done.

Besides the interesting and passionate discussions around the table, the participants enjoyed the mild climate of Southern France and, thanks to the hospitality of the host Jean-Louis Laffont, they could sip some excellent wines, taste the authentic “andouillettes” and even attend a rugby match. ■

ISTA membership changes

Status 1 March 2013

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Method Validation Reports on Rules Proposals for the ISTA Rules 2014 Edition

Revised method for the germination of *Lolium × boucheanum*, *L. multiflorum*, *L. perenne*, *Festuca filiformis*, *F. heterophylla*, *F. ovina*, *F. rubra*, *Poa nemoralis*, *P. palustris*, *P. pratensis*

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Summary

A validation study on the duration of the germination test for *Lolium perenne*, *Festuca rubra* and *Poa pratensis* was carried out. Eight ISTA-accredited laboratories in

seven countries on three continents participated. Per species for samples were germinated at different temperature conditions, and seedlings were evaluated in different moments.

The results show that repeatability and reproducibility were similar for the last two counts in all species, and were at acceptable levels.

The variation introduced by shortening the duration is of the same magnitude as the variation caused by the different temperature regimes.

It is suggested to shorten the duration of the germination test of the indicated *Lolium* species to ten days, of the *Festuca* species to 14 days and of the *Poa* species to 21 days. ■

Proposal for a new method to detect *Xanthomonas campestris* pv. *campestris* in disinfected *Brassica* spp. seed lots

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Summary

ISTA Seed Health Method 7-019 was modified to extract cells of *Xanthomonas campestris* pv. *campestris* (Xcc) located inside the seed coat of vegetable *Brassica* crops that may have survived a hot-water

or similar seed treatment. This new method includes wet seed grinding, ten-fold concentration of extracts, buffered saline (PBS) in a larger ratio to the seed, longer incubation time, changes to the semi-selective media and the pathogenicity test. Wet grinding of seeds was compared to simply soaking seed (as in ISTA Method 7-019), while the ten-fold concentration of seed extracts was compared to the undiluted and ten-fold diluted extracts in a comparative test organized by ISHI-Veg in which eight laboratories participated. Two naturally contaminated hot water treated cabbage seed lots with medium and high pathogen load, and a pathogen-free lot were utilized. The recovery of Xcc (cfu/mL) and the

number of positive seed subsamples (from the 20 tested) obtained using the two extraction methods 'soaking' and 'wet grinding' were compared. Wet grinding strongly enhanced the extraction of viable Xcc cells compared to seed soaking. This same result was repeated and reproduced in three seed lots. In seed extracts with low Xcc and saprophytic load, the ten-fold concentration of the undiluted seed extract after grinding was shown to improve the detection of Xcc cells. The revised protocol was found to be a reliable method for detecting Xcc in disinfected *Brassica* spp. seed lots. ■

ISTA/ISHI comparative test for method 7-021 modification for the identification of *Xanthomonas axonopodis* pv. *phaseoli* (*sensu* Vauterin *et al.*, 2000) on bean seeds

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Summary

This comparative test showed that validation criteria of pathogenicity test, Audy and Diag gene primers give very good results for confirmation of suspect Xap isolates, but are not sure at 100%. The Toth primers give less good results for Xap isolates and are informative only for fuscans isolates which are easy to recognize on media due to the pigments they produce.

All suspect isolates (fuscans and non fuscans) should be tested for confirmation tests.

We propose two options for confirmation of suspect isolates:

Option 1: pathogenicity tests, for laboratories not equipped or experienced with PCR. In this case, CCP must be followed and target and non target controls added (*X. vesicatoria*, Xap, water). This option is also valuable and less time consuming when few suspect isolates have been detected but need climatic chamber or greenhouse equipped for high hygrometry.

Option 2: PCR test with Audy primers. If positive with Audy and a low risk

of false positive result is desired, a pathogenicity test or PCR test with Diag-gene primers can be used as a confirmation step. This option can be used for laboratories experienced and equipped for PCR, when a short delay is needed for obtaining results and/or a high number of suspect isolates have been detected.

The comparative test was carried out on DNA extracted with a Qiagen kit because we needed stable DNA for transport. A bacterial suspension with boiling step (95°C for 5 min) can also be used as primers are used on isolates and not on seed macerate. For routine use, we advise to use a boiling step. ■

Validation of a new method for the detection of *Pseudomonas syringae* pv. *lisi* on Pea (*Pisum sativum*) seed

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Summary

Pseudomonas syringae pv. *lisi* (Psp) is an important seed-borne and seed-transmitted pathogen of pea (*Pisum sativum*).

A detection method of Psp on pea seed was evaluated in a comparative test between nine laboratories organized by the ISHI-Veg, ISF. The method includes a seed wash-dilution-plating on the KBBCA and SNAC semi-selective media, optional biochemical tests on Psp suspects and a pathogenicity test for their confirmation. Three untreated naturally contaminated seed lots with various levels of contamination and one untreated pathogen-free seed lot resulting in forty 1000-seed subsamples were used. A characterization and a stability test on the seed lots were additionally conducted by the reference laboratory

before and after the comparative test respectively. Results of all three tests showed that the pathogen's distribution in the seed lots was heterogeneous and that the seed lots' contamination level decreased in time depending on the lot. Yet, all laboratories in the comparative test detected the expected number of positive subsamples, distinguished the contamination levels and didn't record any false positives. The detection method was shown repeatable and reproducible. It is considered a reliable method for the detection of Psp on pea seeds and is therefore recommended in routine pea seed testing. ■

Peer validation for detection of three fungal pathogens infecting *Linum* seeds by a single method

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Introduction

ISTA currently uses different methods (7-007, 7-017, 7-018) to detect the three main pathogens of flax seeds, *Botrytis cinerea*, *Alternaria linicola* and *Colletotrichum lini*.

The ISTA Seed Health Committee decided to start a research project with the aim of proposing a single standard method for the detection of the three pathogens on flax seeds. A working group, with French and Israeli participants, was created and established a three step approach:

1. Analyze differences between the existing three methods.
2. Perform a pretest to compare conditions and select some for further testing.
3. Perform a peer validation to propose a new validated method.

The first two steps were carried out in a former study in GEVES-SNES laboratory and the results are presented in the attached document.

It was very difficult to obtain seed lots infected with the three pathogens and to be sure of the percentage of infection due to variability in distribution of the pathogens, so it was decided to make an artificial infection. The method used was adapted from that described by Machado *et al.* (2004) and Sousa (2006) for *Fusarium oxysporum* f. sp. *vasinfectum* based on growth of the fungus under water restriction. The principle of this method is based on addition of a high concentration of mannitol to the media to increase the osmotic potential to 1.0 MPa. The pathogen cultivated on these media penetrates the seeds which have a lower osmotic potential. This method allows an artificial infection close to the natural infection to be obtained.

The differences between the three existing ISTA methods were: sample size, temperature, light conditions during incubation, and number of evaluations. In comparison with the routine tests carried out in GEVES-SNES and Volcani Center A.R.O. laboratories the differences were: medium (PDA, addition of 50 ppm or 200 ppm streptomycin) and light conditions during incubation. In other ISTA methods streptomycin can be added at 50 to 130 ppm.

A pretest was carried out in one laboratory at SNES to define the conditions to be tested for the peer validation. Different conditions were tested on four replicates of 100 seeds, which included medium, concentration of streptomycin and temperature and light conditions during incubation.

All conditions tested allowed the detection of the three pathogens, and addition of streptomycin at 50 mg/L in the media was able to restrict the development of bacteria but did not affect the detection of the target pathogens.

The threshold of detection was studied in another pretest with two levels of infection (1% and 2%), on malt-agar with addition of streptomycin at concentration 50 mg/L, with incubation at 20 °C and in darkness for 9 days. The results of this pretest (presented in the attached document) showed that this method allowed detection of *Alternaria linicola*, *Botrytis cinerea* and *Colletotrichum lini* at a threshold of 1%. Sensitivity of the method varied from 73% for *Botrytis cinerea* to 77% for *Colletotrichum lini*. Sensitivity was 100% for *Alternaria linicola*. The specificity was 100% for each pathogen.

The aim of this peer validation test, third step, was to compare three existing ISTA methods (7-007, 7-017, 7-018) and three proposed protocols in order to be able to propose a single method for detecting the three pathogens. Canadian Food Inspection Agency laboratory joined this study, allowing a peer validation between three laboratories.

Conclusion

Results of repeatability and reproducibility show that the detection of *Alternaria linicola* and *Colletotrichum lini* was reproducible between the three laboratories irrespective of the conditions used. Condition 1 gave lower results for the detection of *Alternaria linicola* because this pathogen does not sporulate easily in darkness and the sporulation was taken into consideration by the laboratories as decisive criterion. Therefore, this method has been discarded as it could lead to problems for laboratories not used to identify non-sporulating fungi or colonies.

The detection of *Botrytis cinerea* was less reproducible between the three laboratories. This can be explained by the low infection level, possibly due to the decrease in the level of infection. For this comparative test the stability of the lots in terms of pathogen viability over time was not tested. Pathogen stability should be checked as part of future comparative testing.

Conditions 2, 4 and 5, with addition of streptomycin, gave better results than without streptomycin for *Botrytis cinerea*. Conditions 2 and 4 gave a higher percentage of seed infection.

This comparative testing showed that sporulation was not the only diagnostic criterion for pathogen detection.

Based on these results and to have uniformity with other ISTA methods, in terms of temperature of incubation and using streptomycin, we are in favour of describing a single ISTA method for detecting *Alternaria linicola*, *Botrytis cinerea* and *Colletotrichum lini* by using the following conditions corresponding to conditions 2 and 4 tested during this PT:

- Medium: Malt-agar or PDA with streptomycin at concentration 50mg/L.
- Incubation: at 20 °C for 9 days in darkness followed by 12 h NUV/12 h dark to induce sporulation if problem for pathogen identification arises. ■

Comparative test for a new improved A-PAGE method for the verification of *Triticum*

Ana Laura Vicario¹ and María Alicia Loray

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Summary

The A-PAGE method is used for testing the alcohol soluble storage protein profiles of *Triticum* varieties (gliadins).

The gliadins are extracted from seeds and separated by electrophoresis. The pattern of the protein bands produced is related to the genetic constitution and can be considered as a “fingerprint” of a variety.

The “fingerprints” can be used to identify unknown samples and mixtures, by single seed analysis.

The aim of the comparative test was to evaluate the performance of the laboratory validated A-PAGE method for wheat in comparison with the ISTA A-PAGE method.

The statistical analysis revealed that different methods give similar results compared with the current ISTA method in the Rules. Methods B, from laboratories with the most similar patterns compared with method A (ISTA method), were selected for this proposal.

The scientists involved in this validation consider that each step (1 to 8 of this

new method) is independent from the others. So, the proposed strategy consists on merging some solutions and procedures that were understood go together.

For this new method, laboratories will have options for some of the steps of the procedure. When there are options given, the laboratories will have to select one of them, but not necessarily all the time the same one. For example: a given laboratory will select option 1 for the “extraction solution and extraction procedure”, select option 1 also for the “gel preparation”, while selecting option 2 for the “electrophoresis” and for “fixing- staining”. ■

Validation of a new method: use of SDS-PAGE technique for the verification of *Triticum* and *×Triticosecale*

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Introduction

Species and variety identification by morphological traits of seeds may be difficult or even impossible. In seed testing the identification of *Triticum* spp. and related species such as *×Triticosecale* by seed traits could be difficult because of the high level of seed morphological similarity among these species. Therefore, there is a need for more reliable tools for species and varietal verification of seed lots. SDS-PAGE (Laemmli discontinuous buffer system) is a well known electrophoretic technique widely used in seed protein separation in order

to perform variety characterization. The method is used for testing glutenin profiles of varieties belonging to *Triticum* spp. and related species such as *×Triticosecale*. The HMW glutenins are extracted from seeds and separated by SDS-PAGE, the protein profile is related to a well known genetic background. For wheat varieties the interpretation of the results is based on a alleles catalogue compiled by Payne and Lawrence, catalogues for alleles recognition in *×Triticosecale* are also available.

The electrophoretic pattern can be considered as a “fingerprint” of the variety and can be used to identify unknown samples and mixtures, by single seed analysis.

The technique is described in the “TG/3/11 UPOV Guideline for the conduct of tests for distinctness, uniformity and

stability in wheat”; the aim of this comparative test is to evaluate the performance of the SDS-PAGE technique in seed testing to confirm varietal identity of seed lots and species verification of *Triticum* spp. and related species such as *×Triticosecale*

Conclusion

Based on the results of this comparative test, the SDS-PAGE technique is a reliable tool in seed testing and as consequence the UPOV method is proposed for the inclusion in the ISTA Rules:

- to confirm varietal identity of *Triticum* spp
- for species verification of *Triticum* spp and *×Triticosecale* ■

Laboratory accreditation changes

Status 8 March 2013

Re-accreditations

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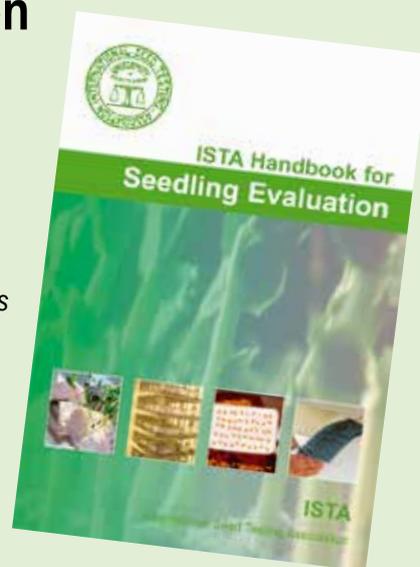
Amendments 2013 to ISTA Handbook on Seedling Evaluation, 3rd Edition, 2009

This latest revision to the ISTA Handbook on Seedling Evaluation follows major changes made to ISTA Rules Chapter 5 in 2010. It includes:

1. Sections on counting equipment and germination apparatus in Section 4: "Laboratory conditions for seedling evaluation"
2. Re-classification of seedling types for *Vigna subterraneae* and *Vigna angularis* (now seedling type G (hypogeal germination))
3. Revision of Appendix 3: Index of Seedling Abnormalities
4. Revision of Sections 12 & 13 to include "scutellum detached from the endosperm" with photos and indications how to evaluate "detached endosperm", and "trapped coleoptiles" and "detached endosperm" for *Zea mays* and *Sorghum* spp.

CHF 50.00 (approx. USD 53.00/EUR 41.00)

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New EU project to enhance seed quality led by the University of Innsbruck

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Each year massive economic losses are suffered by farmers and the seed trade alike due to poor seed quality. These losses are partly due to inadequate storage conditions, and are predicted to be exacerbated by climate change. A team of European scientists has committed themselves to unravel how environmental stresses to the mother plant will impact upon seed quality, and if seed storage conditions prior to the next sowing can be improved to enhance seed quality. The EUR 3 million project will be coordinated by the University of Innsbruck, Austria.

Every seed has a life of its own. Information received during its development on the mother plant determines its quality: how long a seed can be stored, if it will be dormant (see below), if it will germinate readily after storage and if it will grow into a healthy, vigorous new plant. Seed quality is further influenced by storage conditions, and is essentially important to agriculture and industry. It has been estimated that yield loss from major cereals due to rising temperatures between 1981 and 2002 was USD 5 billion per year. Importantly, seed wastage resulting from sub-optimal seed performance undermines food security and livelihoods. High-quality seed and a capability to store them adequately are also pivotal to safeguard the seeds of wild plant species required for the conservation of plant biodiversity. “Seed quality is determined by highly complex interactions between biochemical, biophysical and molecular processes within the seed, which are only very poorly understood” explains Ilse Kranner, Professor of Plant Physiology at the Austrian University of Innsbruck, who is the coordinator of the EU-project EcoSeed. In this project, three crop species, barley, sunflower and cabbage will be studied together with the model plant *Arabidopsis*, to see how drought and elevated

temperatures suffered by the mother plant, impact upon seed quality. As a next step, the scientists want to find out how changes in temperature, humidity and oxygen concentrations during storage further affect seed viability, storability, and seedling vigour. The knowledge gained from the detailed study of the above four plant species will then be transferred to wild plant species to the benefit of conservation projects. Eleven renowned European teams participate in the EcoSeed project. Among them are the Seed Conservation Department of the Royal Botanic Gardens, Kew, maintaining the largest ex situ genebank for wild plant species globally, and the Federal ex situ Genebank of Germany, the IPK Gatersleben, which is the largest crop genebank in the EU. “EcoSeed combines aspects of food security and conservation, and we are lucky to have top-class scientists in the consortium” says Ilse Kranner.

Signalling hubs that determine seed fate

Seed dormancy is an example for the highly complex processes that occur within seeds. Dormancy is the inability of a seed to germinate in spite of favourable conditions before certain environmental cues have been received. For example, in temperate European climates many seeds shed from the mother plant in the autumn will not germinate, even though the environmental conditions such as temperature and soil moisture are ideal, explains the scientist. Before it will germinate the seed needs to undergo an extended period of low temperature during the winter – it then “knows” that spring has arrived. This important seed trait – as well as other traits that define seed quality – is controlled by “signalling hubs” throughout the seed life cycle, from seed development on the mother plant, through processing, storage to germination. These complex signalling hubs comprise plant hormones and signalling compounds such as “reactive oxygen species”, which are of specific importance

to the research area of the Innsbruck team and others in the consortium. The teams will apply the most recent state-of-the-art “omics” (transcriptomics, proteomics and metabolomics) and “post-omics” techniques to unravel factors that determine seed quality on different levels: they will study how genes within the seed are affected by stress, and how this influences the production of proteins and smaller compounds required for a healthy metabolism.

Facts and figures

Funded by the 7th EU Framework Programme for Research and Innovation, the project “Impacts of Environmental Conditions on Seed Quality” (EcoSeed) was awarded a rounded sum of €3 million. EcoSeed is a four-year project running from the start of 2013 to the end of 2016. The project initiation meeting was held at the University of Innsbruck on the 4 February. Apart from the University of Innsbruck (Austria) the following 10 institutions participate in the project: Royal Botanic Gardens, Kew (United Kingdom), Leibniz-Institut für Pflanzengenetik und Kulturpflanzenforschung, Gatersleben (Germany), Université Pierre et Marie Curie (France), Max Planck Institute for Plant Breeding Research (Germany), Warwick University (United Kingdom), Institut National de la Recherche Agronomique (France), University of Leeds (United Kingdom), Universidad de Salamanca (Spain), Commissariat à l'énergie atomique et aux énergies alternatives (France) and Limagrain Europe (France). Within the 7th Framework a total of 10 projects are coordinated by Austrian research institutions.

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ISTA Vigour Testing Workshop

İzmir, Turkey, 4–6 June 2013

The Seed Technology Centre, Ege University and ISTA Vigour Committee invite you to a workshop on seed vigour testing, to be held in İzmir, Turkey from 4th to 6th June 2013. The workshop will be made up of lectures, interactive seminars and practical experience in vigour testing. It will also offer the opportunity for general discussion of seed vigour and time for participants to ask specific questions regarding vigour testing procedures.

Workshop content

This workshop will include new developments in seed vigour that have occurred over the last two years and potential future developments in vigour testing as well as established vigour tests.

Lecture topics

- Introduction to seed vigour, its physiological basis and importance in crop production
- Conductivity test for *Pisum sativum*, *Phaseolus vulgaris*, *Glycine max*
- Controlled deterioration test for *Brassica* sp; application to other small seeded vegetables
- Radicle emergence test: development and validation. Examples: maize, cotton, *Brassica*, pepper, cucurbits, general applicability
- Accelerated ageing test for soybeans
- Seed ageing/metabolic repair hypothesis: the basis of all vigour tests
- Factors affecting seed vigour
- Use of seed vigour

Practical work

All participants will complete the conductivity test and assess results from the controlled deterioration and radicle emergence tests. There will be demonstration of stages in the accelerated ageing and controlled deterioration tests.

Question and answer sessions

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

Presenters of the workshop

- Dr. Alison Powell (Chair of ISTA Vigour Committee, University of Aberdeen, UK),
- Dr. Stan Matthews (ISTA Vigour Committee, University of Aberdeen, UK)
- Dr. Hülya İlbi (ISTA Vigour Committee, Seed Technology Centre, Ege University, Turkey).

Location

The workshop will take place at the Seed Technology Centre, Ege University, İzmir, Turkey. The university campus (<http://ege.edu.tr>) is situated in Bornova, part of the Province of İzmir, the third largest city in Turkey. The University is based in 3700 ha of parkland and is a focus for the educational and cultural life of İzmir. The campus is 15 km from Adnan Menderes airport and about 10 km from central İzmir, and is linked to the city centre by frequent bus and underground services.

The city of İzmir itself is 8000 years old, with a history dating back to the Neolithic Age; the ancient name of the city is Smyrna. It is a harbour city and has had a place in the commercial economy of the Mediterranean region since the 16th century. Both domestic and foreign trade have been highly developed in İzmir thanks to its free-trade zones, international fairs and industrial zones. The harbour is the biggest importer and the second biggest exporter of the country, and the city is the touristic, industrial and cultural centre of the Aegean Region. İzmir also incorporates the nearby ancient cities of Ephesus, Pergamon, Sardis and Klazomenai, and centres of international tourism such as Kuşadası, Çeşme, Mordoğan and Foça.

It is easy to reach Antalya, the location of the 30th ISTA Congress, by air and bus. There are direct flights from İzmir to Antalya twice a day via Sunexpress Airways (www.sunexpress.com).

Local organiser

Hülya İlbi, Ege University, Faculty of Agriculture
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Accommodation

Accommodation is available either at the Anemon Ege Hotel or the Guest House of Ege University.

Anemon Ege Hotel (<http://english.anemonhotels.com/otel.aspx?otel=anemonizmir>) is a short walking distance from the Seed Technology Centre where the workshop will be held. Rooms with breakfast cost € 75 per night (single) or € 95 per night (double). Room fee also includes the transportation between airport and hotel.

Anemon Ege Hotel:
 Tel. +90 232 373 48 62
 Fax +90 232 373 48 63

The Guest House of Ege University (<http://konukevi.ege.edu.tr>) is also a short walking distance from Seed Technology Centre. Rooms with breakfast cost € 30 per night (single) or € 45 per night (double). However, you would need to arrange your own transport from the airport to the hotel. A taxi will cost approximately € 40–45.

Guest House Ege University:
Fax: + 90 232 339 99 93; reservation phone: +90 232 388 1447 4
E-mail: konukevi@mail.ege.edu.tr

Participants should make their own accommodation arrangements. When making your hotel reservation, please copy your e-mails or faxes to the local organiser, or inform her where you will be staying.

Registration

There will be a minimum number of participants required for this workshop to take place, with a maximum number of 20.

ISTA members (includes ISTA laboratory member staff): € 450
Non-members: € 575

Payment for the ISTA Vigour Testing Workshop is required in euros before **3 May 2013**.

Please note: For cancellations made before 15 April 2013, registration fees are refundable less a € 50 administration fee. For cancellations made after 15 April 2013, registration fees are non-refundable.

If you would like to attend the workshop, please fill in the registration form (www.seedtest.org/vig-test). An invoice will be sent to you, which must be paid before participation can be confirmed. Payment can be made by credit card upon individual request to the ISTA Secretariat.

Registration deadline

3 May 2013

ISTA Workshop on Purity and Germination

Ankara, Turkey, 6–9 June 2013

This Workshop is fully booked.

30th ISTA Congress, Antalya, Turkey, 12–18 June 2013
Online registration now open: www.seedtest.org/2013

ISTA Vigour Workshop

Edmonton, Canada 11–13 September 2012

Alison Powell¹ and Stan Matthews

¹ISTA Executive Committee Member, ISTA Seed Vigour Committee Chair

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Eighteen participants from seven countries joined our ISTA Vigour Workshop in Canada. Not surprisingly, the majority came from Canada, but others came from far afield, Japan, Taiwan, Australia, the Netherlands, Germany (2) and France (2). Fourteen of the participants came from seed companies and only one from a government organisation. The workshop was hosted by 20/20 Seed Labs, the only ISTA-accredited private lab in Canada, and held in the Varscona hotel in Edmonton, who provided good facilities for our lectures and practical work. 20/20 Seed Labs have their base just outside Edmonton in Nisku, Alberta, and we had hoped that their new building would be ready to host the workshop, but the work was still ongoing. Nevertheless the Varscona did us proud, and the staff of 20/20 did a wonderful job, not only in preparing the practical material,

but in transporting it into Edmonton with no mishaps!

The content of the workshop included lectures and practical work on the validated vigour tests (conductivity, accelerated ageing, controlled deterioration, radicle emergence). Particular emphasis was given to the most recently validated test, the radicle emergence test, as this holds great promise as a test to be applied to a wide range of species. The explanation for all vigour tests on the basis of deterioration and repair was also emphasised.

We were disappointed that Dr. Bob Elliott from Agriculture and Agri-Food Canada, Saskatoon, was not able to join us to contribute to the workshop, due to illness. Bob's presentations were particularly relevant to people interested in canola in Canada, and oilseed rape elsewhere. However, he kindly allowed us to use his presentations, and Kevin Zaychuk from 20/20 ably presented Bob's work on seed vigour and seed treatments, while Stan Matthews summarised Bob's presentation on the interaction between vigour and tillage practices in

canola. We were pleased to hear of Bob's subsequent return to full health!

In addition to the lectures and practical work, the workshop included two interactive seminars led by Stan Matthews, in which the participants initially worked in small groups to discuss causes of low vigour, target features for vigour tests and research and development priorities for vigour testing. They then brought their conclusions for discussion amongst the whole group. These seminars proved to be very stimulating and lively sessions, which could have gone on for a long time! Experience from within seed companies brought forward many interesting points for discussion and the ready contributions from the participants were much appreciated.

The workshop was not all work! Our social evening took us on a guided tour of the Muttart Conservatory in Edmonton, followed by dinner in a typical diner. The Muttart Conservatory was an interesting visit for plant people, since it presents examples of world flora in three zones – arid, temperate and tropical. Thanks to our guide we learnt about the background and



Participants at the ISTA Vigour Workshop in Edmonton, Canada, September 2012.



Hard at work!

uses of both familiar and unusual species. The conservatory is located in parkland on one bank of the South Saskatchewan River, so we could view the river and the impressive skyline of the downtown area.

We were most grateful to our hosts at 20/20 Seed Labs, in particular Sarah Foster, for inviting us to Edmonton and for their warm hospitality. Many of the laboratory staff worked hard preparing the practical material and transporting it to the workshop venue. It would be difficult to thank individuals in case someone is missed out, but we were grateful to everyone! Even so, a particular thank you must be given to Carey Matthiessen, laboratory manager, who very ably handled all the workshop registration, finances, administration and co-ordination of the workshop.

We left Canada having had a brief but very positive ‘taster’ session of Alberta, the ‘taste’ being further enhanced by the gift of local food goodies given to all participants! We are pleased to report that 20/20 are now in their new premises in Nisku. ■



In the arid zone pyramid of the Muttart Conservatory.

ISTA Workshop for GMO Auditors

Bologna, Italy, 9–11 October 2012

Christoph Haldemann¹, Jean-Louis Laffont^{1,2} and Enrico Noli¹

¹Members, ISTA GMO Committee; ²Chair, ISTA Statistics Committee

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From 9–11 October, LaRAS (Seed Research and Testing Station) of the University of Bologna hosted the first Workshop for ISTA GMO Auditors. LaRAS is an ISTA-accredited laboratory, providing services for private clients and for the Italian government also in the field of GMO testing.

Workshop organizers were Rasha El-Khadem (ISTA Accreditation Department), Rita Zecchinelli (ECOM contact person) and Enrico Noli (GMO Committee member). Lecturers were ISTA GMO

Committee members Christoph Haldemann, Enrico Noli and Jean-Louis Laffont, the latter also Chair of the ISTA Statistics Committee. For the auditors, Ronnie Don, Augusto Martinelli, Jette Nydam, Florina Palada, Anny van Pijlen, Zita Ripka and Anja Ritserveldt attended. Elena Perri (ISTA GMO Committee member) and Daniela Villa (ENSE) participated as observers.

The aim of the workshop was to train the ISTA auditors on requirements related to GMO accreditation, such as laboratory premises, equipment and procedures, staff training, evaluation of performance data (PDE) of adopted methods, and proficiency test reviews.

For those auditors with no previous experience in this field, basic information

on GMOs was first provided, in particular with respect to the objectives of testing and the current analytical approaches. A tour of Seedcalc, the statistical tool widely used in GMO testing, was also provided in this introduction.

The program included also a practical part in the laboratory, with GMO-spiked samples to be analyzed; however, this part was not really “hands on” by the participants, but rather aimed at giving an overview of a typical workflow in GMO testing by PCR. The procedures involved the preparation of the working sample, through grinding, DNA extraction, PCR analysis, to the interpretation and submission of test results, and were demonstrated by LaRAS staff Elena Battistini, Silvia Scacchi and Maria Teriaca. This format allowed the



participants to focus more on the quality-assurance aspects of testing, rather than try to learn its mechanics, but highlighting the critical steps throughout the procedure. In addition, in order to provide a comprehensive perspective on the possible analytical approaches used by ISTA GMO laboratories, for one seed sample the GMO content was determined both by quantitative real time PCR (rt PCR) as well as by qualitative PCR on seed pools.

The topic of GMO quantification was given special emphasis, in particular regarding the unit of expression of results (by seed, mass, or number of copies) in relation to the analytical approach used and the type of reference material. Spreadsheet applications for computing GMO content based on rt PCR data were illustrated.

A presentation on method validation was given providing an overview of the important parameters that need to be checked when applying a method (LOD, LOQ, amplification efficiency, repeatability, reproducibility, bias, etc.). Closely related to this, the PDE document, one of pillars on which the ISTA performance-based approach for accreditation of GMO testing is based, was examined in details, with discussion over actual case studies. The Proficiency Test system, another essential element for accreditation, was also illustrated, with special reference to the rating system. Lastly, a draft checklist for GMO laboratory auditing was presented, and that will need to keep into account the outcome of this meeting.

The workshop was rather intensive and exciting. The lab work provided many stimuli for discussion on practical and theoretical aspects of testing, and also on the critical points in auditing. The feedback from the auditors was very positive and the lecturers could get a lot from this experience. The discussions raised questions which have to be discussed within the GMO committee and to which answers should be given as soon as possible. Many of them will need to be addressed either in the new GMO rules chapter or in a Handbook on GMO testing.

Although the programme was tight, there was still the opportunity to get a feeling for Bologna's warm atmosphere, and to enjoy some tasty Mediterranean cuisine. ■

| | | | | |
|------|----------------|---|---------------------|--|
| 2013 | 27–29 May | ISF World Seed Congress | Athens, Greece | www.worldseed2013.com |
| | 4–6 June | ISTA Vigour Testing Workshop | Izmir, Turkey | www.seedtest.org/vig-test |
| | 6–9 June | ISTA Workshop on Purity and Germination (fully booked) | Ankara, Turkey | |
| | 12–18 June | ISTA Congress | Antalya, Turkey | www.seedtest.org/congress2013 |
| | 24 October | UPOV Council Meeting | Geneva, Switzerland | www.upov.int |
| | 18–22 November | APSA Annual Congress | Kobe, Japan | www.apsaseed.org |
| 2014 | 4–7 March | AFSTA Congress | Tunis, Tunisia | http://afsta.org |
| | 26–28 May | ISF World Seed Congress | Beijing, China | |
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Deadlines

Publication dates: April/October

Booking advertising space: 15 February/

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Artwork delivery: 1 March/1 September

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Seed Testing

INTERNATIONAL

ISTA News Bulletin No. 145 April 2013
ISSN 1999-5229



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