

## ISSS/ ISTA Webinar on Seed Priming

Anca Macovei and Tomoko Sakata have answered all the questions that were sent in during the session in detail below.

### **When it comes to tree seeds, what is the difference between stratification and hydropriming?**

*TK: Stratification is the process to mimic the conditions that seeds require when breaking dormancy in nature. Hydropriming is the process to seed metabolism acceleration by controlling the moisture and environmental condition to accelerate the germination speed. In case some tree seeds, seed would not be able to absorb the moisture without breaking dormancy, and hydropriming is not possible. however some seed may work hydro priming for breaking dormancy. It always depends on the type of seed and what type of dormancy the seed has.*

### **Do growing condition of plants for seed have any effects on germination of uprimed and primed seeds?**

*AM: Surely the environment in which plants grow can impact seed quality, one of the reason why different seed lots are often tested when evaluating priming protocols and their efficiency.*

### **I wanted to ask if you scarified the Medicago seeds before priming/over priming treatments?**

*AM: No, the seeds are not scarified for germination tests in on filter paper. We use scarification only for in vitro growth together with sterilisation protocols.*

### **Are there any special seed priming technology for rice for India?**

*TK: As farmer practice, seed soaking is popular. In industry level, yes, we have technology, however it would not been used yet. It would be grateful if the information regarding detail demand in India would be shared with me.*

*AM: Seed soaking could be an option for rice. I do not know if it is used in India, but some rice growers are using it in Italy.*

### **Do growing condition of plants for seed have any effects on germination of uprimed and primed seeds?**

*TK: Yes. The condition where sown the seed and its growing condition are influence on germination of seeds: both of unprimed and primed. However the impact on germination by environmental factors, would be less in primed seed generally because it is ready to germinate and dormancy is relieved by priming.*

### **When you talk about overpriming, what do you mean exactly? Does this mean that seeds during priming starting to germinate?**

*TK: Over priming : if seed germinate during process, it is clearly over priming. However, if priming recipe is not optimal (too strong) and seed deterioration or germination decrease happen, then we can say that it is also over priming for industry use purpose.*

*AM: This generally means that the treatment time exceeds the second phase of the pre-germinative metabolism. In Medicago truncatula after 24 h of imbibition we get different population of seeds, some with radicle protrusion and others not; however this timepoint goes beyond phase II which in this case is between 8-12 h.*

**Could you comment on whether your suggested protocols for primed seed germination could also be used to test the vigor of seed lots? Equally, do you think any current vigor tests (e.g. the radicle emergence test) could be used to test primed seed?**

*TK: yes, the test methods which I shared in webinar to evaluate the priming effect, would be workable as vigor test. And, the vigor tests such as radicle emergence test would be good tool to check the priming effect to evaluate the germination speed improvement.*

**Question for Anca: One of the figures you showed, showed that repair only happens during the early germination phase. Do you think it could ever happen during maturation (e.g. if seeds experience natural de-hydration/rehydration events when they are still on the plant)?**

*AM: That's a very good question, thank you. We are mainly studying the repair during germination, because the DDR pathway is rapidly activated during imbibition, so conditioned by water entry in the seed. Water loss generally lowers both metabolic and transcriptional activities while this may be more related with epigenetic changes. There are very few investigations in this system, and I remembre just one work there a mismatch repair gene knockout was investigated also during seed maturation (DOI: 10.1016/j.plaphy.2019.11.035) with the observed impacts being more correlated with the cell cycle rather than the repair process. It would be surely quite interesting to better investigate these aspects!*

**Can we do seed priming in vegetatively propagated vegetable crops like pointed gourd and ivy gourd?**

*TK: as far as it has seed, priming would be possible.*

**Between environment factor and genetic factors which affected more seed quality and involve seed dormancy?**

*TK: it is quite difficult to say which is influenced more. both influence on germination, and seed production condition also influence on seed quality and dormancy level.*

*AM: Aside the two factors looked separately, surely one should consider more the interaction between both.*

**How are seed-associated pests managed during priming?**

*TK: not suggest to apply priming on the seed which infested by pest.*

**Before priming treatment, during storage, is there any way (can we say priming?) to protect seeds for longer and to get better germination?**

*TK: After optimize the seed moisture, packaging the seed in moisture prove bag and store in the optimal condition for seed storage such as 15'C 30% RH. This is the very basic however practical working way in seed industry*

*AM: We are also trying to better undersand these aspect. At the moment, our hypothesis is that using protective agents during priming may help in prolonguing the seed shelf life after priming.*

**We have learned that seed vigour is physiological process controlled by many biotic and abiotic factors. Is there any evidence that we can alter gene to stop ageing process**

*AM: To stop the aging process would be rather difficult, but at least to slow it down, it may be possible both by impoving the DDR activity as well as by connecting/relating it with phytohormone interrelations.*

**Research says priming does better for medium vigour seeds rather than high vigour. That means priming is good for carryover seeds rather than fresh seeds. In seed market will it be ok to sell medium vigour seeds after priming. Since seeds will be stored at farmers level also. And seed validity is 9 months.**

*TK: priming is the process to accelerate the metabolism. If we use other word, we can say that it is kind of optimized artificial aging process. So, high vigor /fresh seed is better and safer, and high possibility to keep the good shelf life. It is not suggested to use on deteriorated seed or aged seed for priming. Priming application on Medium quality seed : it depends on the quality level. most important thing is to understand the raw seed quality well and make judgement whether priming applicable in practical commercial level, and determine the proper recipe which fit to the each seed lot.*

**Is there any chance to develop gel based coating for Soybean seed?**

*TK: I know that Gel base coating is technically available, however I am not sure whether it is applicable on Soybean. I am very curious the purpose of gel coating on soybean.*

**Is Different bio priming will have same effect as of chemo priming?**

*TK: it is quite difficult to answer. There are many type of bio priming and Chemo priming. It depends what biopriming is compared with what chemo priming.*

*AM: This may depend on how the treatments are delivered in a first place. We observed improved DDR and antioxidant activities also after biopriming, but compared with the chemical treatments, these are observed mayng during seedling development rather than during seed imbibition/pre-germinative metabolism.*

**What is seed priming? What is the relation between seed priming technique with seed size, seed coat type, embryo type?**

*TK: nowadays, we can say that, the definition of the word of 'priming' is used to express the wider techniques, which can improve the germination, not only metabolism control. So the relation between technique and type of the seed (seed size, seed coat, embryo type) would be different per technique. Generally, thinner and fragile seed coat type of seeds are difficult to apply hydro-priming.*

**Is seed priming applicable for cotton seed?**

*TK: technically it would be possible.*

**We have difficulty getting the priming right with soybean seeds. Even in pre-conditioning we still see a lot of damage due to imbibition. Is there any protocol that we can apply?**

*TK: Unfortunately, I don't have experience of soybean priming because I haven't got chance to try it so far. However I can imagine that hydropriming would be challenging due to imbibition damage, fragile seed coat and large seed volume in industry level. I am very curious what germination challenge in soybean practically in farmer level, and what kind of germination improvements are expected by priming.*

**During drying to its original moisture sometimes seed are over dry. to escape from this overdrying of seed after imbibition is there any solution?**

*TK: Dryer which can control both of temperature and RH, would be helpful to dry back the seed moisture to target range while avoiding over drying.*

*AM: maybe use of silica beads can be of help.*

### **Could we have get data on Soyabean**

*TK: Unfortunately, I don't have experience of soybean priming. Therefore I don't have nice data. If farmer has chance to sow the seed at sub optimal condition such as lower / higher temperature condition, the n germination test at less than 20°C and more than 30°C would be interesting with counting from around 3 DAS would be interesting to know.*

### **On practical view how priming will be helpful to Seed industry. I am from India ????**

*TK: Priming is helpful to get faster, uniform and stable germination at various condition including suboptimal condition. It can be workable as insurance to get better germination even though seed get environmental challenging after sown. The high vigor seedling by priming would have higher potential to adapt to the environmental stress. This is especially valuable in open field sowing. And faster and uniform germination by priming is valuable especially in nursery business to increase the efficiency of seedling production and grafting especially in the economical point of view. In addition, priming has effect to relief the dormancy.*

### **What is shelf life period for corn after seed priming**

*TK: unfortunately, I don't have experience of priming in corn. However, shelf life always depends on the raw seed quality and method /recipe of priming.*

*AM: This has to be analyses on case-to-case basis, cosidering type pf seeds, species, and treatments.*

**The radicle emergence test is a vigour test based on germination rate so it could be used to evaluate seed priming in comparison to a control**

*TK: absolutely*

### **Can exogenous ROS scavengers reduce over priming if applied?**

*AM: This is an interesting point that worth testing. At least in theory it should work. Combining screening startegy for the choice of most appropriate substance to be used can aid with the identification of such potential treatments. However, it would still be better to have available these markers/indicators which can give you an idea of when the seeds are going into overpriming and stop the treatments before.*