

Seed Dormancy Webinar

David Johnston and Ganesh K. Jaganathan have answered all the questions that were sent in during the session in detail below.

Can you share information about the Bittergourd dormancy ?

GKJ: *Bittergourd belongs to Cucurbitaceae, a family known to produce physical dormancy. I have done some work to safely conclude the wild populations have physical dormancy. For those commercially obtained in India may not have any dormancy.*

Can you elaborate on Table 5A - KNO₃ and Prechill?

DJ: *You can use both KNO₃ and Prechill together at the same time. Moisten the substrate with KNO₃ solution, sow the seeds and then conduct the prechilling.*

Do you have any experience with laser?

GKJ: *I have never had any experience with laser. But I know laser can break physical dormancy if that was the question.*

What happens when a seed die?

GKJ: *If it meant when a seed would die during dormancy break, then too much exposure to acid or high temperatures (fire temperatures) could easily kill physical dormant species. But a seed could die anytime from maturation to germination.*

Ganesh, can you provide me your email please?

GKJ: *jganeshcbe@gmail.com. You are welcome to contact me.*

GA₃ is very costly to use. Are there any other options for rice?

GKJ: *Alternatively, you could try cold stratification, but it would be costly again. This is because you need a chamber and power supply. Therefore, GA₃ is the most reliable option.*

Do you think your hypothesis applies to break up physical dormancy in agronomical crops such as soybean or clovers?

GKJ: *It certainly does. I have been investigating this in soybean and peas. However, most agronomical crops were domesticated, meaning the dormancy genes might have been knocked off. I would not be surprised if drying results in no onset of the impermeable seed coat. This offers exceptional benefits during the plantation.*

What are the Factors responsible for secondary dormancy?

GKJ: *First, the seeds must not germinate. Then every environmental factor known to induce primary dormancy would induce secondary dormancy. This may include biochemicals such as ABA, cytokinins, IAA, etc., which could increase and decrease for inducing secondary dormancy.*

DJ: *Possible causes include temperature extremes, too hot or too cold, by prolonged darkness or prolonged light, by water stress, too much or not enough, by lack of oxygen/gas exchange.*

Do you know if dormancy can come back after a while?

GKJ: *I would assume you are talking about secondary dormancy. It is a common phenomenon, especially in physiologically dormant species.*

With in pod some seeds are dormant and some are non dormant what could be the reason?

GKJ: *I would think this is due to the variation in moisture content attained. Thus, you might have collected the seeds during maturation drying, where some seeds completed drying and others were*

about to. I don't know how you measured impermeability in your studies. But it is hard to know such variations precisely within a pod, as both moisture content and germination is destructive.

How to integrate seed dormancy break techniques with restoration of degeraded habitats/deserts?

GKJ: This is an important question, and I humbly think restoration projects greatly benefit from the dormancy studies. I could list hundreds of benefits. For example, many weeds have physical dormant species, and knowing how they persist and germinate can help choose the sites for restoration. I have seen some restoration projects use fire to clear the vegetation and create a canopy, and there is a chance physical dormant species would remain unaffected.

Can you explain the treatment of placing the seeds in a polythene envelope during the germination?

DJ: ISTA Rules 5.6.3.1 Sow the seeds on the appropriate moistened substrate and place them inside of a polythene envelope (e.g. resealable plastic bag).

To my knowledge, seed dormancy consisted of primary (endogenous: embryo, physiological-) & exogenous (embryo covering, physical-), and secondary dormancy (induced & enforced). Can you further explain?

GKJ: This classification runs into several problems. I cannot list all here. But what is the difference between induced and enforced? Similarly, exogenous is due to seed coat covering, but it could be due to the embryo being unable to push the thick coverings. Let us consider if we have species with primary dormancy- more specifically, exogenous (embryo covering), and what dormancy-breaking treatments we can apply—also, considering primary dormancy (endogenous, embryo physiological), what dormancy-breaking techniques can we apply? For both, GA3 would be beneficial. If so, why distinguish endo and exo, which are physiological dormancy according to Nikolevia's scheme. More importantly, both can be broken by the same dormancy-breaking treatments.

Could you use ERH as well as oven drying?

GKJ: We certainly can.

Can you use smoke treatments for grasses in ISTA testing?

DJ: Smoke treatment is not in the ISTA Rules.

Observing dormancy with just dispersed pearl millet seed, do you suggest any effective dormancy break method?

GKJ/DJ: First, you need to determine what is causing dormancy. I'd have to assume the dormancy is physiological, a common feature in the Poaceae family. I think GA3 treatment (500 or 1000 PPM) would do the trick. Please note PPM is not an acceptable unit anymore. I have used preheating to break dormancy.

**Can artificial drying of crop seeds lead to physical dormancy or is it species dependant
What molecules exactly differentiate species?**

GKJ/DJ: If the genes responsible for physical dormancy were not knocked off owing to the need during domestication, artificial drying would result in physical dormancy. Reg, what molecules differentiate species, we should be able to answer this in a few years./ Yes - I have experienced that over drying seeds can induce secondary dormancy in some species.

Can you tell about the physical dormancy in Mungbean and preharvest sprouting problems in Mungbean?

GKJ: I have seen this problem before. Mungbean has physical dormancy. However, preharvest sprouting is due to what humidity you store them. Water-rich environments let the seeds imbibe to the point where you can see germination. However, this only happens if you collect the seeds early, i.e., in

a permeable state. I would guess drying them immediately after collection would solve this problem, as the seeds would onset impermeability.

I have seen infrared treatment break physical dormancy. is it possible?

DJ: I do not know the answer.

Reporting for breaking dormancy and viable seed (TZ test) on OIC. Is it report once requesting only?

DJ: At the end of the germination test, if there is suspected to be more than 5% fresh seeds, their viability is required to be determined and reported on the OIC.

What is mechanical dormancy?

GKJ: Mechanical dormancy could be caused by the seed coat restricting the embryo, which is also physiological dormancy. Thus, why not call it physiological dormancy?

Which method is good for identifying the seed borne pathogens?

GKJ: Identifying pathogens is really a difficult task. For those studying seeds, pathogens are problematical. But for those studying pathogens, they find it important. So the method would depend on the purpose.

Recently Indian scientist discovered 62 new species of plants that can survive extreme water scarcity as they undergo dormancy, can you shed some light on this?

GKJ: I am not aware of this finding. Could you please let me know more about it.

In bitter melon, we are getting very good germination in nursery tray sowing but not in the open field. What may be the reason?

GKJ: Most likely, the soil and the temperature experienced by the seeds are different.

What kind of dormancy can we find in Sponge melon?

*DJ: For *Luffa* spp. seems to be impermeable seeds coat.*

https://www.researchgate.net/publication/333335429_Dormancy_breaking_in_seeds_of_different_accessions_of_Luffa_cylindrica_Roemer

Does Prechill+KNO₃ works better for Brassica?

DJ: Yes

If we store paddy seed in 10 degree C for 1 month then is there any chance for breakdown the dormancy?

GKJ: I have not done this, although I have previously worked with paddy and wheat. But it is an excellent experiment we can do to understand more.

Why alternative temperature is more effective in analysis of seed germination.

GKJ: It is always because that is what seeds experience in the natural environment. As humans, we try to mimic what they experience. However, the seeds could also germinate at constant temperatures because seeds buried in the soil have that ability.

Can you give more information about epicotyl dormancy?

GKJ: Epicotyl dormancy occurs during the seedling stage, which contrasts with seed dormancy.

The same species moved from an environmental to another change behaviour from orthodox to recalcitrant. What do you think?

GKJ: This is what we think might have happened in the past resulting in orthodox or recalcitrant categories. I don't want to go into the revolving debate of which is the ancestral trait, but if we allow a few more thousand years, such transformation is more likely.

For what concerning the MOI determination according to MOI TCOM we will stay in contact and we will have a comparison among us. As him I have a doctorate on recalcitrant species?

GKJ: *I'm sorry, I couldn't understand this question. Please send me an email; I will definitely answer the question.*

About spinach, which is an average moisture content?

DJ: *I do not know best moisture for storing spinach seeds.*

It is not simple to determinate dormancy with TEZ test.

GKJ: *I completely agree. Tetrazolium tests can only inform us whether the seeds are alive. It would not tell us if they have dormancy. However, the most likely explanation for a seed that is alive and did not germinate at all the possible (or ecologically meaningful) conditions, this is most likely due to dormancy. We can make that inference.*

Can TZ test be done post germination for remaining hard seeds?

GKJ: *The best is to apply dormancy-breaking treatments, as it would confirm if the seeds were dormant.*

Are there any dormancy studies on Cotton seeds. We have tested cold and Hor vigoro test in the lab, but surprise is it is irreversibly given the result in soils.

GKJ: *I know little about dormancy in cotton seeds, as my colleagues and I did not witness dormancy. Please send me more details; I will look up and answer.*

How to break dormancy of seeds of bitter gourd?

GKJ: *The best route is to try hot-water treatment for different durations. But you must confirm that the seeds have physical dormancy.*

Do you have experience with citrus seeds cold storage and seed germination? They are recalcitrant.

GKJ: *For starters, Citrus is not recalcitrant, it is an 'intermediate'. I think many studies have been carried out (please see Hor et al. 2005 Annals of Botany).*

In terms of seed water requirements for germination, is there an optimum percentage of water to promote germination and not induced secondary dormancy if it is excessive or too dry?

GKJ: *Interesting question. But again, is this for physical or physiological dormancy? If it is the former, then definitely yes. For the latter, it is tempting to answer 'yes', but we don't know this clearly.*

Is there any listed procedure for breaking dormancy in Spinacia sp.?

GKJ: *I'm afraid, there are no listed procedures. But there are many studies.*

Are there any relationship with genetical influence in physical seed dormancy?

GKJ: *Absolutely. genetics influence physical dormancy a lot, but equally important is the maternal environment.*

For wild eggplant rootstock seeds there seen dormancy. What can you say about light effect for breaking dormancy?

GKJ: *I have never worked with eggplant seeds, nor have I seen any papers on this topic. Therefore, I may not be the right person to answer this question.*

Do you have any idea GA3 and light threatment for breaking dormancy for eggplant rootstock?

GKJ: *I'm afraid, as I mentioned, I have never worked with eggplant.*

What are the main visible characteristics of dominant seeds in a germination test?

GKJ: *There are no visible characteristics, which is why this is a problem. Indeed, distinguishing between a dormant and dead seed is often hard.*

Many believes, cooling down reduces dormancy. Do you agree with this method applied at Brassica and Helianthus?

GKJ: *I don't know what is cooling down. But cold-stratification can break dormancy in Brassica.*

Have you ever meet (or read about) physical dormancy on Brassica species?

GKJ: No. I don't think Brassica species have physical dormancy.

What would relieve physical dormancy, heating or drying?

GKJ: Heating certainly will. The evidence for drying relieving physical dormancy is less clear, especially if the water-gap would open or not.

During dormancy experiments, is it necessary to have 10 degree difference in day/night temperature (16hour/8 hours)?

GKJ: I'm not sure if this for germination or dormancy. But it would depend on environmental conditions you are trying to mimic.

In Malvacea species weed I am presently working having physical dormancy, instead of alternating temperature, constant low temperature (15 °C) dormancy breaking is effective, why is it so?

GKJ: This is quite unusual. You mentioned 15 °C but for how long? Without knowing more details, it would be hard to answer correctly.

Is damage caused by high temperature (lethal temperature) related to the moisture content related to ROS species formed from water molecules?

GKJ: Yes

For small seeds prepared for TZ tests, where the cutting seeds could be tedious, what is the statistical number seeds needed to conclude about the viability?

GKJ: I assume ISTA rules explicitly state this. In our lab, we used the same number of seeds we used for germination to determine this.

Coriander seeds normally germinates in 14days but we need to reduce this time to 7days. Could you please inform how to shorten the germination period (days) of coriander seeds?

GKJ: I understand this is an important requirement when preparing seeds for plantation. I have been contacted many times with such requests. We certainly can, just before sowing, treat the seeds with GA3. I have not read any studies, but from our experience, 100 PPM or anything below 200 PPM should accelerate germination. However, I have no experience with coriander. If you do such experiments, I would be happy to learn more. Please keep me informed.

Can dry heat treatment (in machine) reduce the dormancy period?

GKJ: Dormancy cannot be reduced. But dry heat can break dormancy, and the duration depends on the temperature and the initial state of the seeds.

Does low temperature also helps in breaking PY (Sunflower) apart from PD?

GKJ: I think dormancy in sunflower seeds is not due to the impermeable seed coat. It is most likely physiological dormancy. Temperature does affect physiological dormancy break.