SCIENCE SETU WEBINARS by NIPGR

NITRIC OXIDE: MULTIFACETED AND FACINATING SIGNALLING MOLECULE IN PLANTS

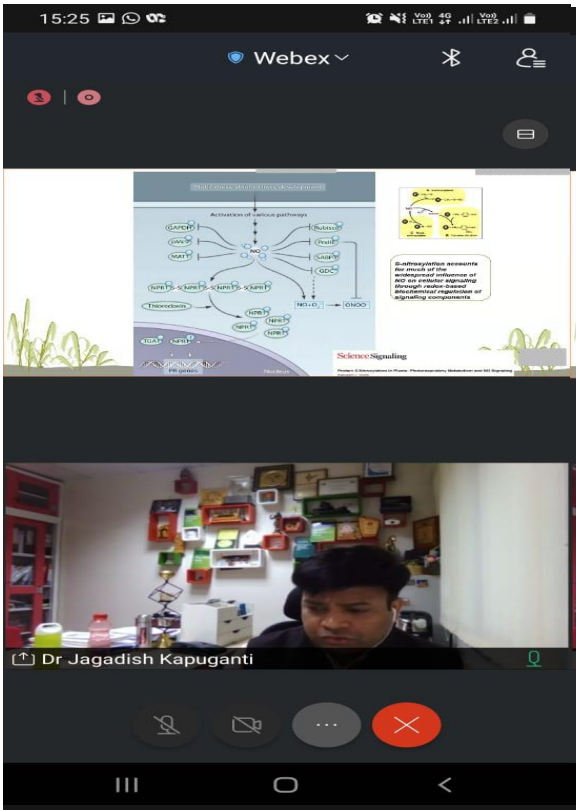
Press Note

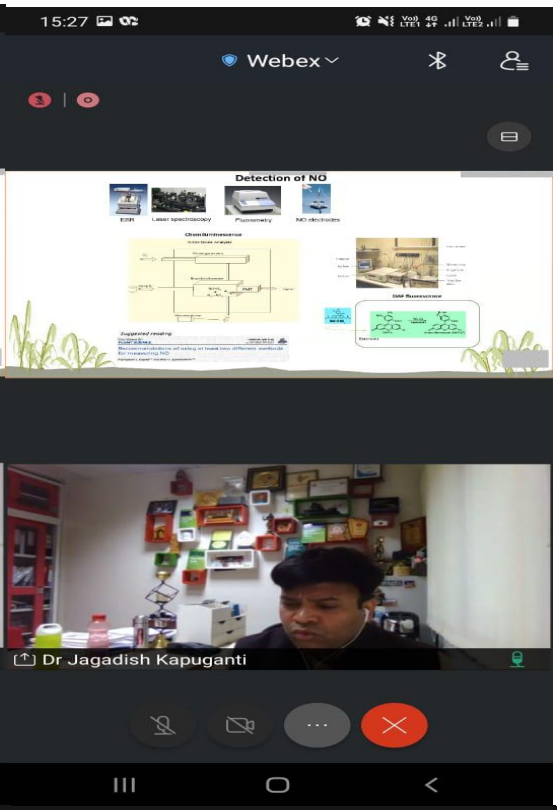
Date: 12th NOVEMBER, 2021, Friday

Resource person: Dr. Jagadis Gupta Kapuganti, Scientist V, NIPGR

The Department of Biotechnology, Government of India, had planned "Science Setu Webinar" as a virtual platform to connect the Research Institutes with postgraduate and graduate students. Under this, our college has been assigned to National Institute of Plant Genome Research (NIPGR), New Delhi. NIPGR is an autonomous institution aided by the Department of Biotechnology. Research at NIPGR focusing on functional, structural, evolutionary and applied genomics of plants, including crop plants. Through this fourth webinar program, our students and faculty members virtually gained an amazing opportunity to connect with NIPGR, New Delhi and anticipated the effects of combined stresses of environmental factors on plant life. It was a spectacular opportunity for students at undergraduate and postgraduate level of science background on exposure to plant-based research on much higher level.

Dr. Amarjeet Singh, Scientist, NIPGR gracefully introduced the resource person with his warm words. The resource person, **DrJagadis Gupta Kapuganti**, Scientist V, NIPGR, opened his lecture with the introduction of nitric oxide (NO). In plants, NO reflects the net effect of NO generation To identify the amount of NO in plant analysis is done by various spectrophotometress. He also explained steps involved in DNA-MT method. He explained the effects of single stress, sequential stress, multiple single stress and combined stress on plants. He gave method of indirect detection of NO. He emphasized in the hypoxic stress due to the nitriaacid and their use in hypoxic signaling and protection of plants. He discuss the various consequences of physiological significance of anaerobic nitric dependent NO emission. He explained the reason behind slower germination of Desi and Kabuli chick pea. Activation of polyamine pathway under nitric nutrition leads to resistance. At the end of his lecture, he acknowledged his team and their publications in relation to the dry root rot disease. In total 53 participants, including faculty of science and students attended the event. Dr. Pinky Agarwal, Scientist, NIPGR attended the questions of the participants and gave vote of thanks. It was a quite exciting and brainstorming experience for everyone.


15:25
Webex
Activation of various pathways
S-nitrosylation accounts for much of the widespread influence of NO on cellular signaling through redox-based modification of a subset of signaling components
Science Signaling
Dr Jagadish Kapuganti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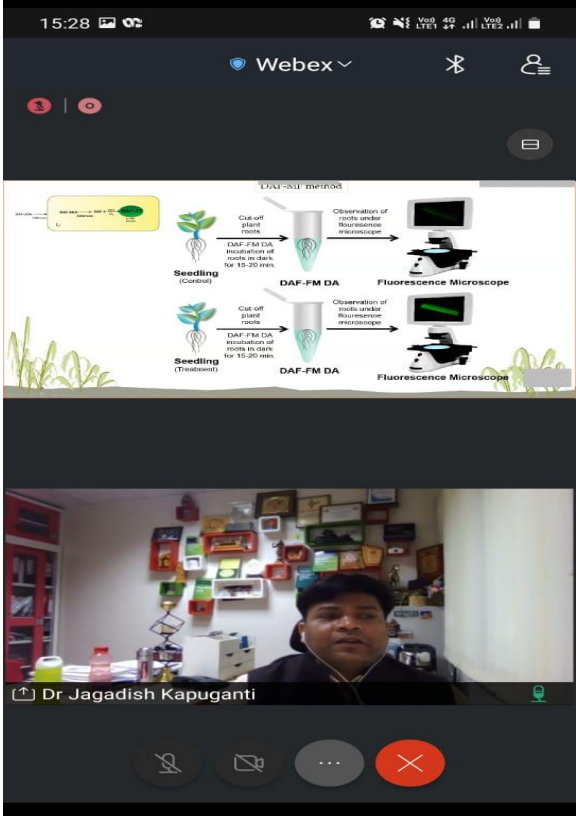
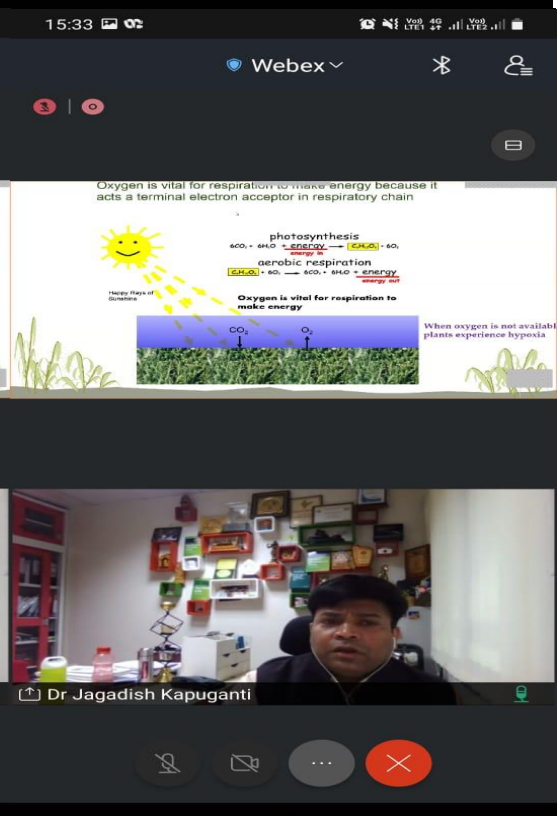
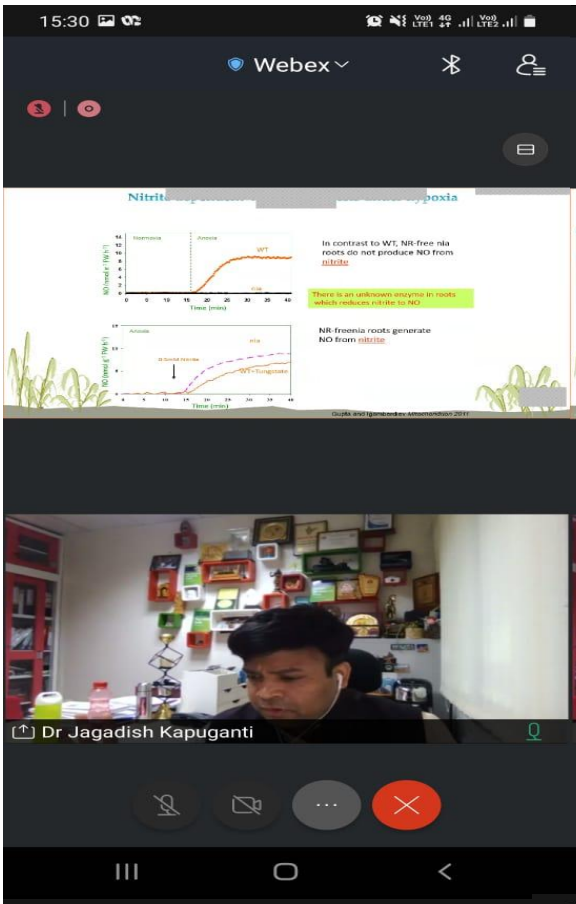
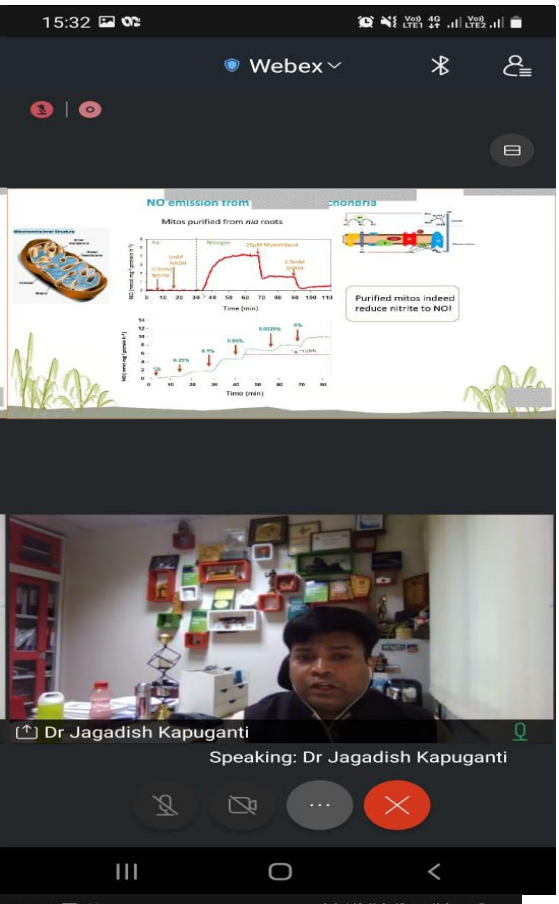
Webex
Detection of NO
ESR
Laser spectroscopy
Fluorometry
NO electrodes
Chemiluminescence
Gold fluorescence
Dr Jagadish Kapuganti


15:28
Webex
DAF-FM DA method
Cut-off plant roots
DAF-FM DA incubation of roots in dark for 15-20 min
Observation of roots under flourescence microscope
Seedling
(Control)
DAF-FM DA
Fluorescence Microscope
Seedling
(Treatment)
Dr Jagadish Kapuganti


15:33
Webex
Oxygen is vital for respiration to make energy because it acts a terminal electron acceptor in respiratory chain
photosynthesis
aerobic respiration
Oxygen is vital for respiration to make energy
When oxygen is not availabl
plants experience hypoxia
Dr Jagadish Kapuganti


15:30
Webex
Nitrite
In contrast to WT, NR-free nia roots do not produce NO from nitrite
There is an unknown enzyme in roots which reduces nitrite to NO
NR-freenia roots generate NO from nitrite
Dr Jagadish Kapuganti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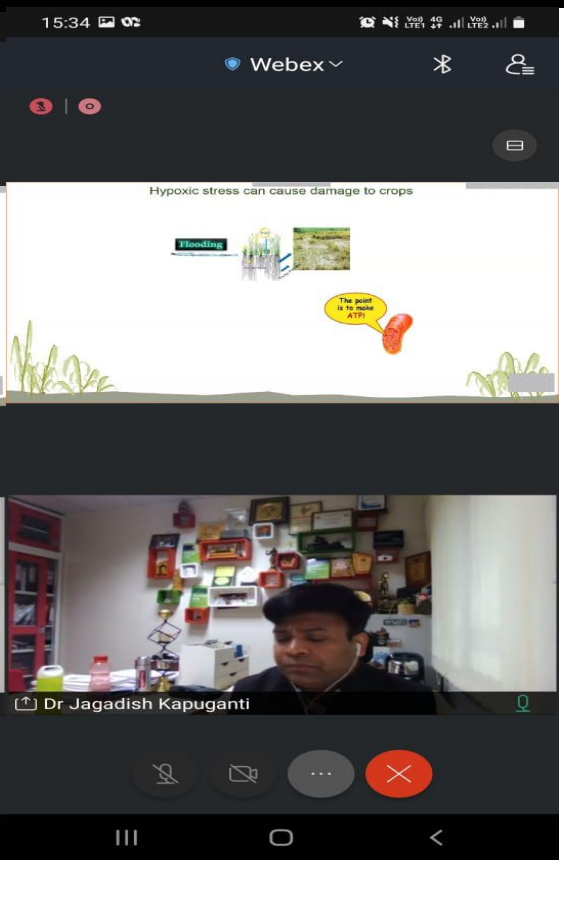
Webex
NO emission from
Mitos purified from nia roots
Purified mitos indeed reduce nitrite to NO!
Dr Jagadish Kapuganti
Speaking: Dr Jagadish Kapuganti


15:35
Webex
Role of hypoxia induced NO in hypoxic signalling and protection of plants
New Phytologist
Hypoxia
NO
Dr Jagadish Kapuganti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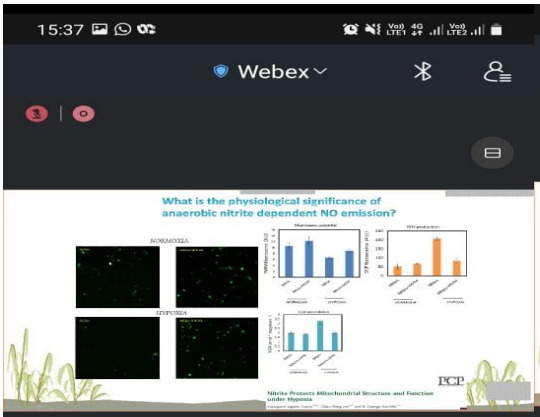
Webex
Hypoxic stress can cause damage to crops
Flooding
The point is to make ATP!
Dr Jagadish Kapuganti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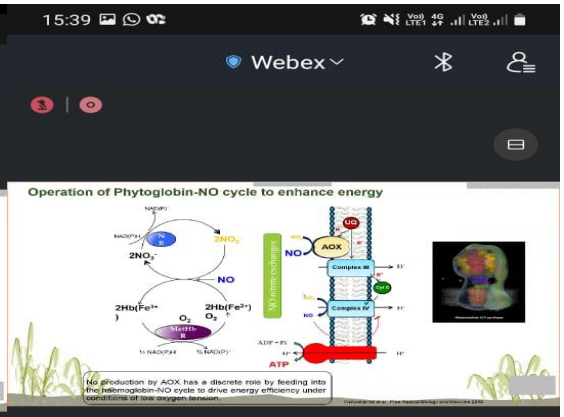
Webex
What is the physiological significance of anaerobic nitrite dependent NO emission?
Nitrite Protects Mitochondrial Structure and Function under Hypoxia
PCP
Dr Jagadish Kapuganti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Webex
Operation of Phytoglobin-NO cycle to enhance energy
AOX
Complex III
Complex IV
ATP
NO production by AOX has a discrete role by feeding into the haemoglobin–NO cycle to drive energy efficiency under conditions of low oxygen tension.
Dr Jagadish Kapuganti


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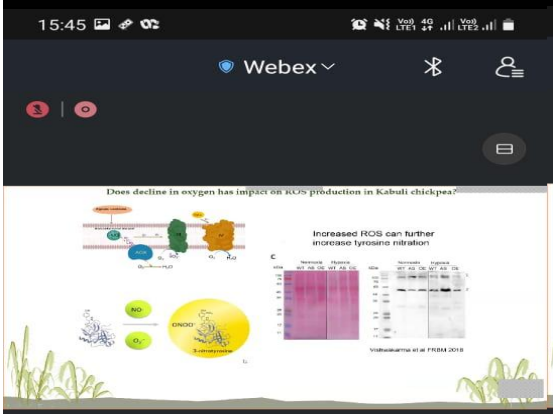
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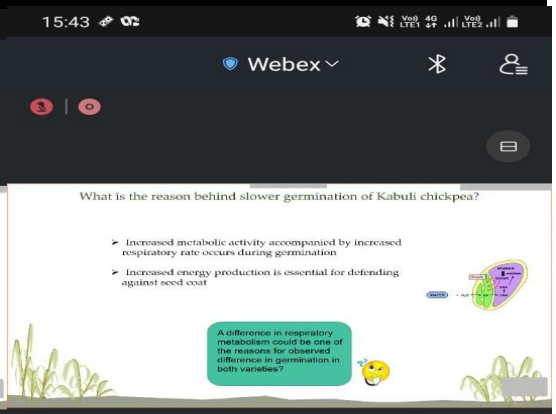
Webex
Does decline in oxygen has impact on ROS production in Kabuli chickpea?
Increased ROS can further increase tyrosine nitration
Dr Jagadish Kapuganti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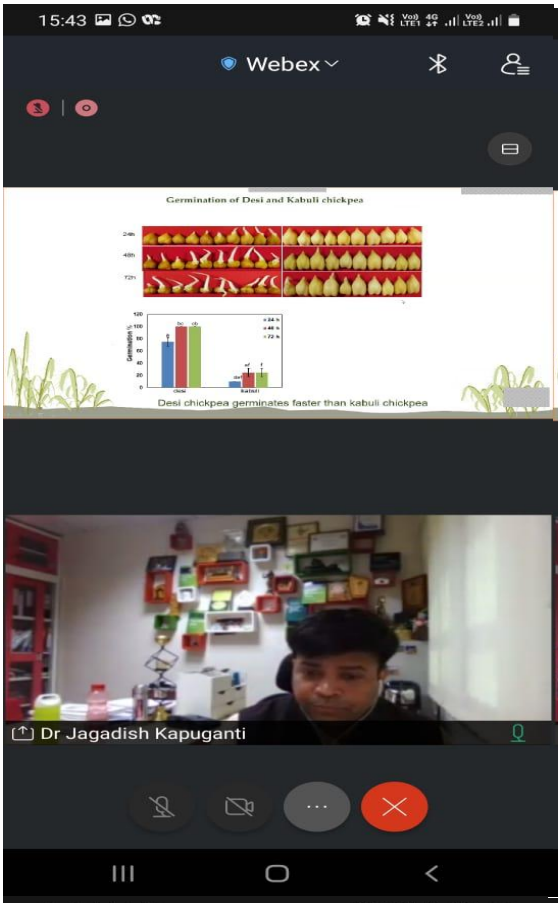
Webex
What is the reason behind slower germination of Kabuli chickpea?
Increased metabolic activity accompanied by increased respiratory rate occurs during germination
Increased energy production is essential for defending against seed coat
A difference in respiratory metabolism could be one of the reasons for observed difference in germination in both varieties?
Dr Jagadish Kapuganti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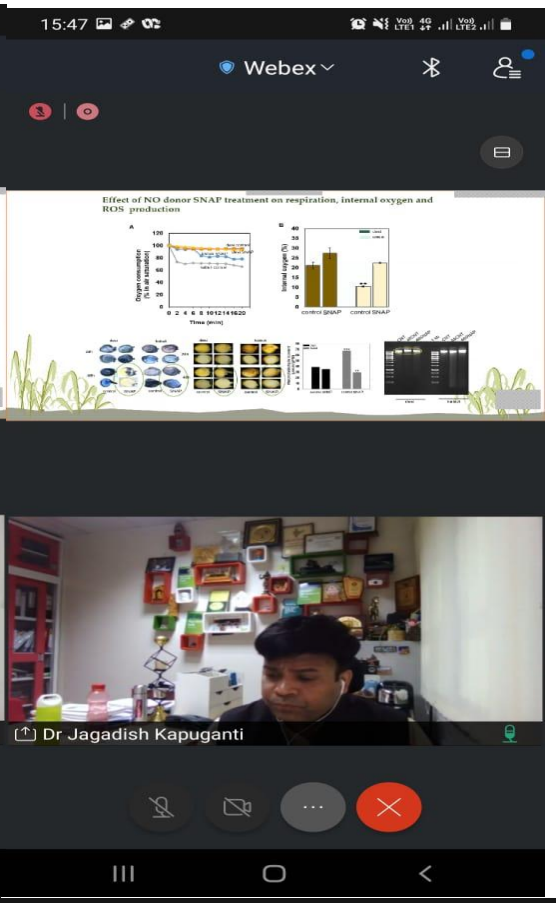
Germination of Desi and Kabuli chickpea
Desi chickpea germinates faster than kabuli chickpea
Dr Jagadish Kapuganti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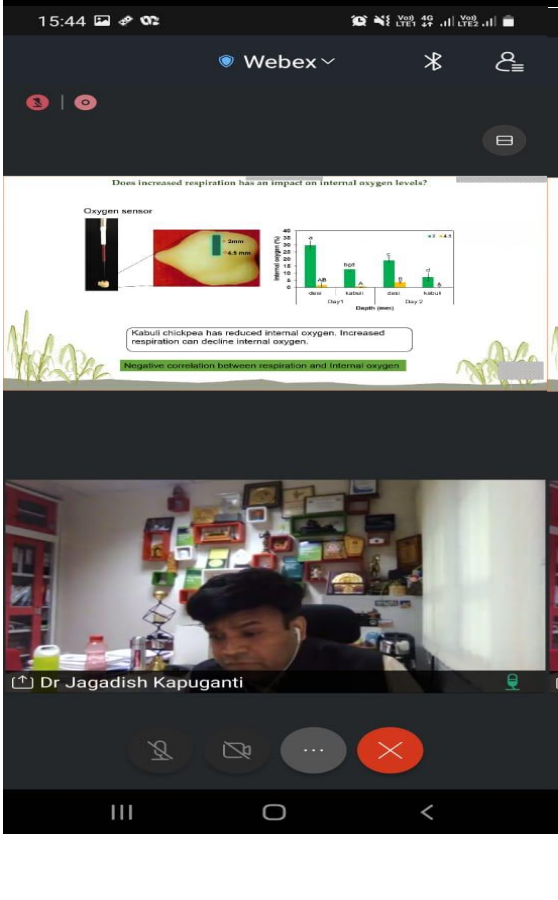
Webex
Effect of NO donor SNAP treatment on respiration, internal oxygen and ROS production
Dr Jagadish Kapuganti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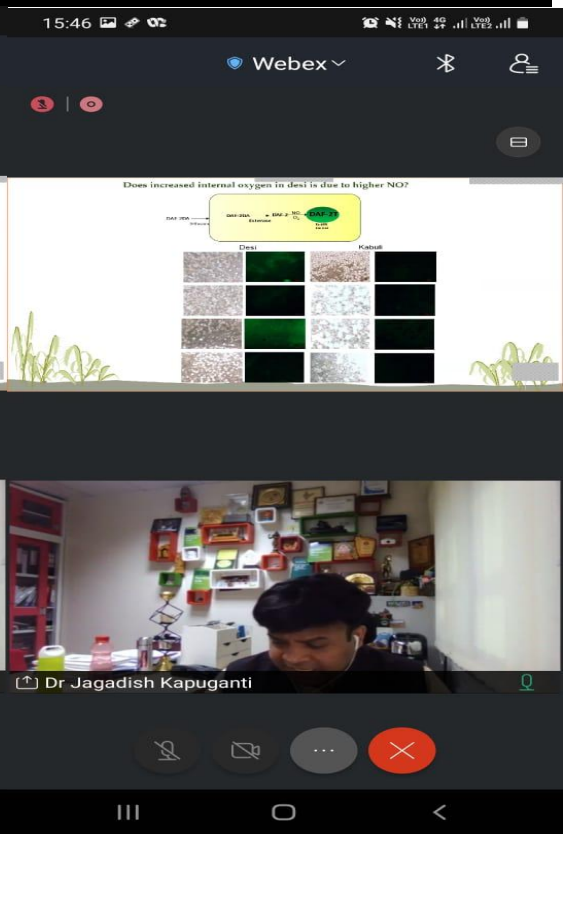
Webex
Does increased respiration has an impact on internal oxygen levels?
Oxygen sensor
Kabuli chickpea has reduced internal oxygen. Increased respiration can decline internal oxygen.
Negative correlation between respiration and internal oxygen
Dr Jagadish Kapuganti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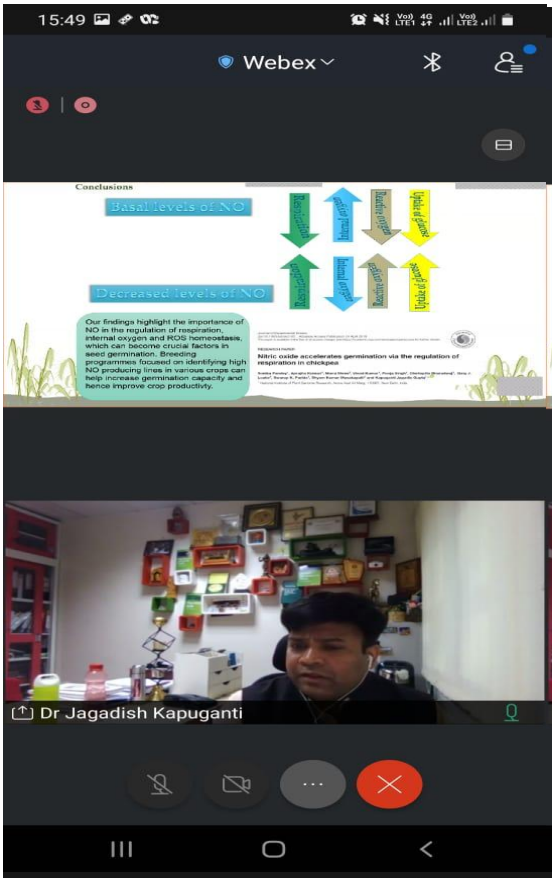
Does increased internal oxygen in desi is due to higher NO?
Desi
Kabuli
Dr Jagadish Kapuganti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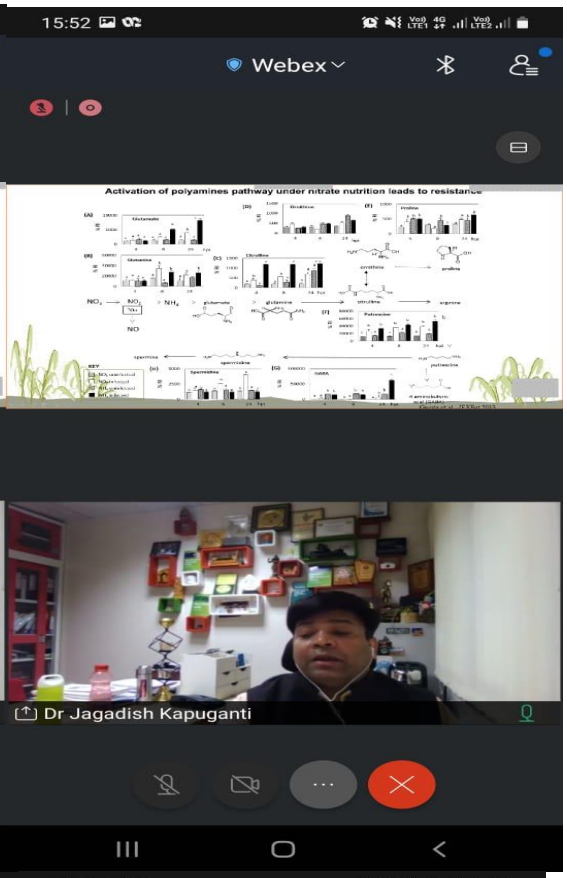
Conclusions
Basal levels of NO
Decreased levels of NO
Our findings highlight the importance of NO in the regulation of respiration, internal oxygen and ROS homeostasis, which can become crucial factors in seed germination. Breeding programmes focused on identifying high NO producing lines in various crops can help increase germination capacity and hence improve crop productivity.
Nitric oxide accelerates germination via the regulation of respiration in chickpea
Dr Jagadish Kapuganti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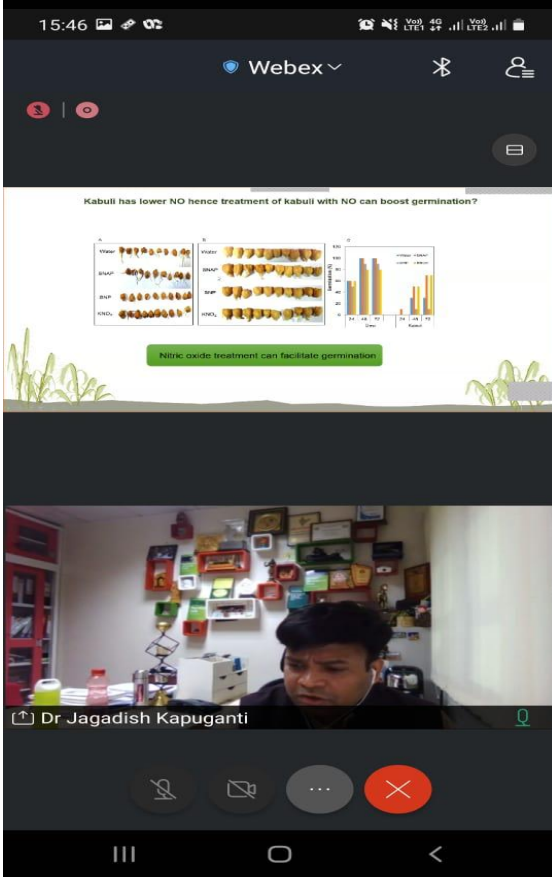
Activation of polyamines pathway under nitrate nutrition leads to resistance
Dr Jagadish Kapuganti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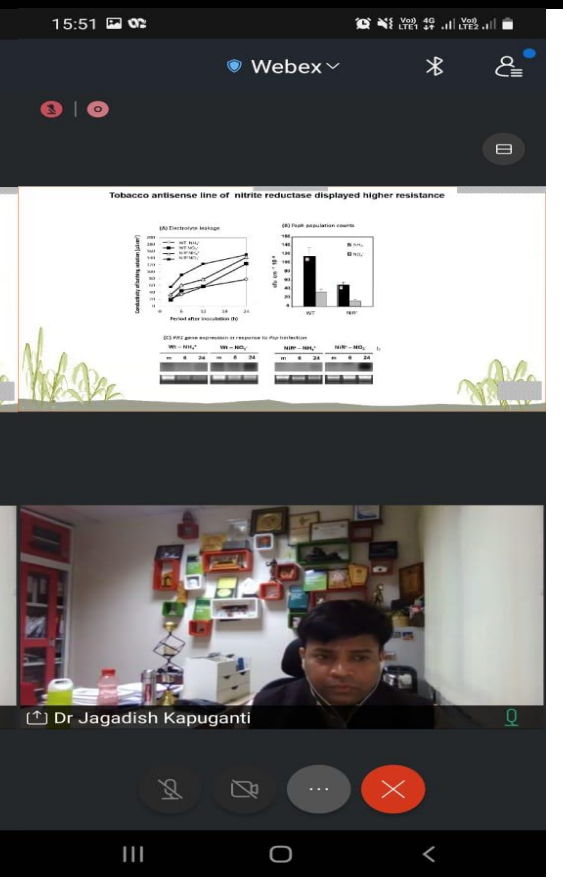
Kabuli has lower NO hence treatment of kabuli with NO can boost germination?
Water
SNAP
SNP
KNO3
Nitric oxide treatment can facilitate germination
Dr Jagadish Kapuganti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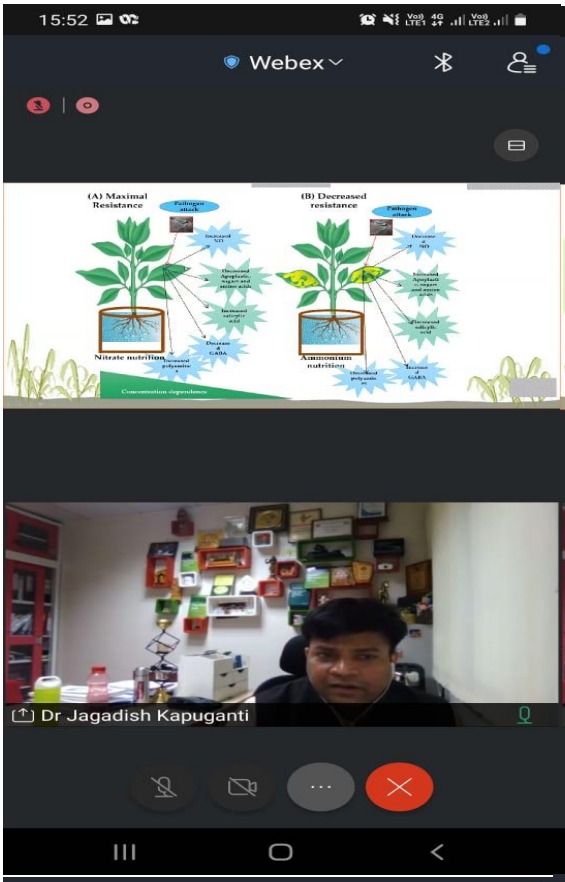
Tobacco antisense line of nitrite reductase displayed higher resistance
Dr Jagadish Kapuganti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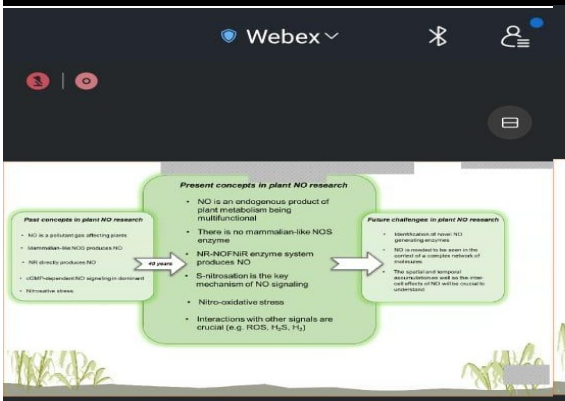
(A) Maximal Resistance
(B) Decreased resistance
Pathogen attack
Nitrate nutrition
Ammonium nutrition
Dr Jagadish Kapuganti


15:55
Webex
Present concepts in plant NO research
Past concepts in plant NO research
Future challenges in plant NO research
40 years
NO is an endogenous product of plant metabolism being multifunctional
There is no mammalian-like NOS enzyme
NR-NOFNiR enzyme system produces NO
S-nitrosation is the key mechanism of NO signaling
Nitro-oxidative stress
Interactions with other signals are crucial (e.g. ROS, H_2S, H_2)
Dr Jagadish Kapuganti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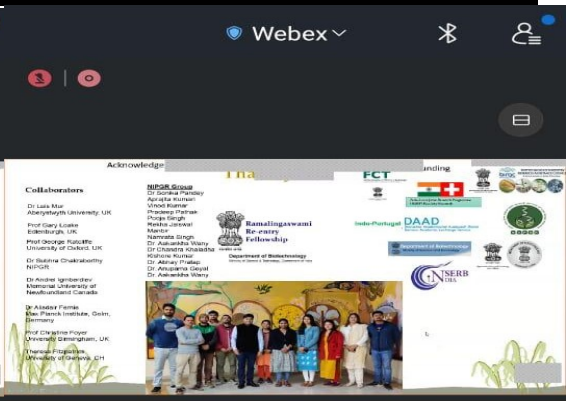
Dr Jagadish Kapuganti


Webex
Acknowledge
Collaborators
NIPGR Group
Ramalingaswami Re-entry Fellowship
FCT
DAAD
Dr Jagadish Kapuganti

Attendance list

S.No.	Class	Roll No.	Name
1.	B.Sc. Med Sem-III	215315	Muskaan Kaur
2.	B.Sc. Med Sem-III	215309	Muskan Gill
3.	B.Sc. Med Sem-III	215318	Shreya
4.	B.Sc. Med Sem-III	215303	Priya
5.	B.Sc. Med Sem-III	215302	Anshika
6.	B.Sc. Med Sem-III	215310	Shruti
7.	B.Sc. Med Sem-III	215307	Shereen
8.	B.Sc. Med Sem-III	215306	Siya
9.	B.Sc. Med Sem-III	215314	Kamni
10.	B.Sc. Med Sem-III	215308	Neha
11.	B.Sc. Med Sem V	215401	Akrit Kaur Gill
12.	B.Sc. Med Sem V	215402	Simranjit Kaur
13.	B.Sc. Med Sem V	215403	Deela Davis
14.	B.Sc. Med Sem V	215404	Arshdeep Kaur
15.	B.Sc. Med Sem V	215405	Ritika
16.	B.Sc. Med Sem V	215407	Amandeep Kaur
17.	B.Sc. Med Sem V	215408	Meghna

18.	B.Sc. Med Sem V	215409	Samiksha
19.	B.Sc. Med Sem V	215410	Simarjit Kaur
20.	B.Sc. Med Sem V	215411	Priyanka
21.	B.Sc. Med Sem V	215414	Kritika Thakur
22.	B.Sc. Med Sem V	215416	PalakChandel
23.	B.Sc. Med Sem V	215417	ShefaliNaryal
24.	B.Sc. Med Sem V	215418	Palak
25.	B.Sc. Med Sem V	215419	KajalKumari
26.	B.Sc. Med Sem V	215438	DivyaBadhan
27.	M.Sc. Serm-I	2110004	Mala
28.	M.Sc. Serm-I	211001	Deepika
29.	M.Sc. Serm-I	2110002	Amita
30.	M.Sc. Serm-I	2110009	Mehak
31.	M.Sc. Serm-I	2110005	Shubhneet
32.	M.Sc. Serm-I	2110008	Saba
33.	M.Sc. Serm-I	2110007	Priyanka
34.	M.Sc. Serm-I	2110010	Shweta
35.	M.Sc. Serm-III	2110051	Urvashi
36.	M.Sc. Serm-III	2110052	Kajal