Rice Research: Open Access
ISSN: 2375-4338

Mini Review Open Access

Development of Seeds from Fertilization to Formation of a New Plant

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Introduction

Multispectral imaging and single kernel near-infrared spectroscopy are used for determination of rice seedling health and variety separation of winter wheat and nine winter triticale varieties due to variation in the chemical composition. Fusarium disease-infected parts of the rice seedling surface were successfully distinguished from uninfected parts with use of a multispectral imaging device. The study produced an interesting result of successful distinguishing between the infected and uninfected parts of the rice seedling surface. Furthermore, the study was able to distinguish between varieties. Here high pressure gas discharge the collision between electrons and gas molecules occurs frequently. This causes thermal equilibrium between the electrons and gas molecules. Even in cold plasma the electron temperature is still typically several thousand centigrade [1]. Cold plasma is one in which the thermal motion of the ions can be ignored. Consequently there is no pressure force, the magnetic force can be ignored, and only the electric force is considered to act on the particles. Examples of cold plasmas include the Earth's ionosphere.

The flow discharge in a fluorescent tube. Cold plasma processing methods possess many advantages in agriculture, owing to their operation at low- temperatures and short processing times, without inducing damage to crops, foods, rice seedlings, humans and the environment.

Plasma discharges produce reactive neutral species, charged species, electric fields and ultraviolet radiation. These factors cause the change in density of reactive oxygen species, reactive nitrogen species, oxidation-reduction potential, and electrical conductivity and so on, and affect rice seedling germination, rice plant growth and the quality of agricultural product. Plasma applications to agricultural production operations.

The contribution of plasma technologies in agricultural operations are limited to the decontamination of rice seedlings or crops intended for sowing or storage, disinfection of processing surfaces or tools, the enhancement of rice seedling germination or growth, production of nitrogen based fertilizers, soil remediation, reduction of pathogen invasion, and the removal of ethylene from air to reduce the rate of ageing.

Discussion

Sirova reported that the rice seedling growth during germination involves two key steps, primary cell elongation of the axial part of the embryo, simultaneous or delayed cell division in the radicle meristem. Ji reported that the rice seedling germination is initiation of embryo breaking the dormant stage and always start with imbibition of water [2]. Rice seedling germination activity involves several physiological and biochemical changes such as protein synthesis, enzyme activation and starch metabolisms. The authors have also reported that the rice seedling germination always hindered by rice seedling dormancy factors which is undesirable process. The cold plasma can be applied by two different ways, Direct treatment of rice seedlings, indirectly treating the rice seedlings with plasma activated water or plasma acid. In direct treatment method the rice seedlings are directly placed in between the electrodes or placed under the plasma regime like in plasma jets. Direct exposure of chickpea rice seedlings to atmospheric cold air plasma for minutes observed an overall increase in rice seedling germination [3]. The authors have reported that the increase in the rice seedling conductivity and rice seedling roughness after the plasma treatment is the main reason for enhancement. The increase in rice seedling roughness or etching caused by bombardment of reactive species may be the reason for increase in hydrophobicity of rice seedlings. Violleau reported that the oxygen plasma treatment of corn rice seedling rice increased the germination rate and higher yields. Another study conducted by Puligundla on effect of corona discharge plasma jet on sprouting of rice seedlings. Exposure of rice seedlings for a minute increased the germination rate by compared to untreated rice seedlings. The authors have reported that exposure of rice seedlings resulted in scarification; formation of deep longitudinal cracks on the rice seedling surface, increase in surface area attributing to increase in surface energy. In this type of treatments the rice seedlings are treated with plasma activated water [4]. The PAW is generated by application of cold plasma on the water surface or underneath water using different plasma sources. Volin reported a significant delay in the germination speed of rice seedlings treated by Fluorocarbon plasmas. Their findings are just the opposite to our results. When they exploited fluorocarbon plasmas, the rice seedling coat characteristics were modified via plasma deposition of hydrophobic materials, which would decrease water absorption and thus result in delayed germination. In our experiments, the helium plasma was exploited, which might make improvement in the wettability of rice seedlings and eventually influence their germination speed. Jiang showed that the treated rice plant had a better growth than the control at booting stage. Compared to the control, the treated wheat rice seedling had longer root, higher height and heavier weight, therefore they were better at absorbing water and nutrition, and could get more light for photosynthesizing. The effect of cold plasma treatment could improve the growth of wheat not only at rice seedling stage but also at booting stage. At the same time, we found that chlorophyll content of the treated wheat was higher than that of the control, indicating that cold plasma treatment could increase the physiological activities of wheat [5]. Li reported that cold plasma had an active effect on soybean rice seedling germination. The germination and vigour indices were increased by cold plasma treatments. The T2 cold plasma treatment produced the highest stimulatory effect among the different treatments; however, a cold plasma treatment with lower

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Received: 27-Oct-2022, Manuscript No. rroa-22-82106; **Editor assigned:** 29-Oct-2022, PreQC No. rroa-22-82106 (PQ); **Reviewed:** 12-Nov-2022, QC No. rroa-22-82106; **Revised:** 18-Nov-2022, Manuscript No. rroa-22-82106 (R); **Published:** 25-Nov-2022, DOI: 10.4172/2375-4338.1000336

Citation: Abayneh K (2022) Compounds Necessary for Plant Growth and Their External Supply. J Rice Res 10: 336.

or higher energy levels had no significant influence on rice seedling germination. According to Dobrynin, the interaction of cells with plasma might improve the activities of rice seedling germination enzymes and accelerate the decomposition of the rice seedling's inner nutrients which might contribute to the increased rice seedling reserve utilization and rice seedling growth. Zhou also reported that tomato rice seedling growth was improved by atmospheric pressure plasma treatment. The present study demonstrated that a cold plasma treatment promoted soybean rice seedling growth, especially the treatment. However, if the cold plasma treatment used a lower or higher energy level then no significant effect was observed on rice seedling growth [6]. Effect of cold plasma was more dramatic on root growth than shoot growth. A novel technique to monitor real-time oxygen consumption during early phases of rice seedling germination A novel technique allows long-term monitoring of real time oxygen consumption during rice seedling germination in an open system. Most current techniques used to detect oxygen consumption by rice seedlings measure the decrease in oxygen concentration in a closed chamber. Oxygen electrodes are used to measure the steady-state concentration of oxygen in the solution, which is a function of both the rate of oxygen consumption by the rice seedling and the rate of aeration from the atmosphere [7]. The rate of aeration is directly dependent on the oxygen concentration of the bathing solution; therefore, previous calibration of the system allows the direct conversion of steady-state oxygen concentrations into oxygen consumption rates. This is an adaptation of a technique and concept first developed for monitoring oxygen consumption by rice plant cell suspensions in an open system. Routinely, rice seedlings were placed in beakers fitted with rubber stoppers. All components of the apparatus that were in contact with the rice seedlings were rinsed with Clorox prior to use. Rifampicin, was added routinely to the bathing buffer, except where mentioned, to minimize the effects of bacterial contamination [8]. This technique utilizes a principle that allows oxygen consumption to be estimated in an open system. The principle is based on Fick's first law of diffusion, which states that the rate of diffusion of a gas into a liquid will increase as the partial pressure or concentration of the gas in the solution decreases. In this technique, as the rate of oxygen consumption by the submerged germinating rice seedlings increases, the oxygen concentration of the surrounding bathing solution decreases. Consequently, this decrease in Oxygen concentration causes an increase in the rate of diffusion of oxygen from the atmosphere. These two processes, oxygen consumption by the rice seedling and aeration from the atmosphere, establish a new steady state concentration of oxygen in the bathing solution, which is monitored by an oxygen electrode [9]. Once the system has been calibrated, the net oxygen consumption by the rice seedlings can be calculated directly from the oxygen concentration of the bathing solution. They stated that that real-time monitoring of oxygen consumption can provide useful information about rice seedling germination that is not easily obtained by other techniques. The technique is able to detect and quantify changes in metabolic activities that occur as rice seedlings progress through different phases of germination. The ability to measure multiple samples simultaneously on a minute-by-minute basis allows subtle and quantifiable comparisons to be made therefore, potentially, the effect of various additives, hormones or treatments on rice seedling metabolism can be quantified, as well as associated with the phase of germination affected. This technique also has potential to provide insight into interactions of rice seedlings with microorganisms, as shown here by studies with a bacterial bio-control agent.

Conclusion

In addition, it offers the possibility to monitor oxygen consumption beyond germination sensustricto and through embryo emergence, with small rice seedlings that germinate rapidly, as shown here with mustard. The same model was tested on a validation set of rice seedlings. These rice seedlings were divided into two groups depending on germination ability, were predicted as viable and expected to germinate and were predicted as dead or non-germinated rice seedlings. This validation of the model resulted in correct classification of the rice seedlings.

Acknowledgement

None

Conflict of Interest

None

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