

Examining the Effects of Magneto Priming on Rice and Determination of Crop Indices from Absorption Spectrum for Ecological Yield

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Abstract: A magnetic field is a kind of therapy for plants that boosts plant health and plants immunity. I have considered rice samples and prepared those for therapy with the help of different fertilisers and soil quality is of prime concern. Plant biochemistry, structure, and photosynthetic pathway all have a major impact on radiation absorption in the photo synthetically active radiation (PAR) zone. Instruments are used to measure the effects of these traits on absorbed PAR, root and shoot length for determination of various parameters including Nitrogen nutrition index. The health of the crop depends on numerous factors including primary chlorophyll enhancement and regulation on behalf of its post-sown treatment for better yield in PB-41 and PB-06. In this paper, natural crop therapy is used which reduces the use of pesticides and urea which leads to less soil pollution and less water pollution in the agriculture sector and is environment friendly. By using this technique one can improve the nutritional values of crops. Results have been validated by MATLAB. Study reveals the investigation of the magnetization on rice before and after sowing. It shows that a magnetic field with controlled intensity is helpful to grow crops with better immunity and yield which requires less number of pesticides and less amount of urea to provide better outcomes which is environment and soil-friendly and helps the microorganisms to support productivity.

Key words: PB-06, Chl-A, Chl-B, PB-41, biomass, leaf growth, magneto priming, photosynthetic performance, YEACI, soil and water treatment, MATLAB.

Introduction

We quantify the effects of functional, structural, and biochemical traits of vegetation and crops on the relationship between the absorption coefficient in the PAR region (α_{par}) and canopy characteristics like the fraction of PAR absorbed by photosynthetically active vegetation ($fAPAR_{green}$) and chlorophyll (Chl) content.

One can do this by using a semi-analytical modelling framework for deriving the absorption coefficient of plant and crop canopies from reflectance spectra. The study's reflectance dataset comprised simulated data from a canopy reflectance model (PROSAIL). Additionally, empirical data were collected both locally (using field spectrometers) and remotely. The Magnetic field energy is captivated which is the result

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of the relations among the outer Magnetic impression and the captivating endeavour of free electrons. This power is changed into a chemical type and accelerates the straightforward development of seed (Commoner et al., 1954). It is helpful to decide the straight and oblique possessions of magnetisation on diverse crops, and vegetables in the early growing stage but it should be applied in short tenures on the fissure of 1-2, 5-7, 9-11 days, respectively. The main motive of the research is to control the chlorophyll content and carotenoids. The rice samples for PB-06 and PB-41 also known as India Gate Rice are under observation. The whole process starts in the last week of May after Rice is sown in Punjab they are placed under the influence of a magnetic field which is a continuous field obtained from permanent magnets and its strength is more than earth's geomagnetic field. Paddy leaves are treated under open environmental conditions. Temperature was 42° C and humidity in May was approximately 43% during plantations. Engineered materials (ENMs) are discharged into the environment after usage. This might pose a threat to the agricultural ecology, particularly for crops like rice (*Oryza sativa* L.), which provides food for over half of the world's population and is heavily reliant on irrigation water. There is, however, a dearth of reliable and comprehensive data on the impacts of nanoparticles in rice. Currently, the major global threats to crop production and plant growth are harsh climatic and environmental conditions. Magnetopriming (the method of preparing seeds in a static magnetic field) is a field that has gained popularity in recent times because it does not require the seeds to be immersed in harmful chemical solutions. So it is environment friendly which provides good nutritional value food while reducing the contaminants during crop stages. Magneto-priming is essentially a substantial priming technique that reprograms the cellular and tissue culture of seeds in reply due to variations in magnetic field strength, the nutritional balance has been improved, and the antioxidant machinery has been activated. Detoxification of damaging cellular oxidants dependent on antioxidants allows seedling germination from magnetically prepared seeds to effectively respond to oxidative stressors. PS-I and breadth are two central and essential physiological forms in the direction of carbon budget and carbon sink within the earthbound biological system, as well as evaluation and input of exceedingly unpredictable and changeable natural situations. Lifted CO₂, saltiness, alkalinity, dry season, surge, supplement insufficiency and harmfulness, extraordinary cold and warm, and different characteristics and the change

of photosynthetic and respiration processes, danger posed by human poisons eventually have an impact on the ultimate production. Plants adjust them by changing their physiochemical and atomic structures. An illustration of how future climate change would affect plant shapes, capabilities, and yield potential is presented first. At that moment, the changes and reactions in the photosynthetic process is observed as per the progression of feasible atmosphere (Mohammad Sarraf et al., 2021). In experimentation, it has (Florez et al., 2019) been observed that the root length growth is better in the case of rice.

Literature

Zhang et al. (2009) determined the crop indexes with the influence of magnetic fields in order to achieve high nutritional yield which is environment friendly. In both typical and upsetting situations, magneto priming has appeared guaranteed as a seed-priming procedure, expanding seed energy, plant execution, and efficiency. Later on, deliberates have seemed that lingering photosynthesis can raise biomass accrual and edit submission which is in common. The plants that developed from magnetoprimed seeds had bigger takes off, new weights, thicker midribs, and fewer veins. Resulting seed Magneto priming offer's advancements in chlorophyll level and its carotenoid levels along with PS-II yield due to significant relinquish of electron transport, stomatal conductance, the crusade of the proteins carbonic anhydrase (CA), Rubisco, and PEP-carboxylase. (Bjorkman et al., 1987; Genty et al., 1990; Li, G. et al., 2010). Moreover, the polyphasic chlorophyll *a* fluorescence (OJIP) temporal appeared a more prominent fluorescence generation at the J-I-P stage (Qiu et al., 2021). Ahmad and Wyn Jones (1979) observed inorganic ion levels in barley seedlings by using MF treatment.

At magnetic field of 30mT, the 3% improvement in height and weight are observed. Even microwaves can be used for crop treatment (Singh et al., 2020). All plant species are clearly well suited to their respective surroundings, but it is not always clear what anatomical and physiological traits are necessary for this kind of adaptation. The impacts of various photosynthetic pathways are of particular importance because they are linked to variations in plant anatomy and structure at both the leaf and canopy scales. Plant species can differ significantly in their ability to absorb photosynthetically active radiation (PAR). C3 and C4 plant species, exhibit different cell arrangements and chloroplast distributions

within their leaves (Qiu et al., 2021). It has been (Yao et al., 2005) observed that UV radiation has a positive impact on cucumber seeds. The common gears of our earth, such as aqua, temperature, type of weather and stimulating charges, Earth's geomagnetic field (GMF) may be a component that impacts numerous natural forms in plants (Dey et al., 2022; Islam et al., 2020; Maffei et al., 2014; Sarraf et al., 2020). Poor germination and seedling emergence are the main deterrence of direct seeded rice production that causes the decline of seedling growth and yield around the world. Synergistic priming with 2.5% KNO_3 +3.5% SiO_2 , 5% KNO_3 +3% SiO_2 , 1mM SA+5% KNO_3 , 2.5mM SA+2.5% KNO_3 , 3% SiO_2 +2.5mM SA and 3.5% SiO_2 +1mM SA be useful on increasing germination rate, seed growth, seedling biomass and seedling Igor of FARO₄₄ rice seedlings (Ali et al., 2021; Islam et al., 2020). It has been proven that MF has positive effects on samples of Wheat DBW-187, and PBW-725 when they are under the influence of 150mT to 350mT even the leaf therapy is used to improve the immunity in crops but it should be applied in given intervals (Singh et al., 2023). Kallar grass in saline land helps bring the soil back to life (Akhter et al., 2004; Hasanuzzaman et al., 2014). As shown in Saletnik et al. (2022) study, magnetisation has positive impacts on yield.

Methodology

Prior studies have shown that magnetic field (MF) therapy is effective for treating human illnesses. By

increasing the distribution of energy over biomolecules within the plant cell, MF accelerates the pace of seed sprouting, vegetative growth, and regenerative development. A known quantity of 100 mg of weighted PB-06 leaf tissues can be combined/mixed well with 10 mL of 80% acetone, and stored at 4°C for overnight. After centrifuge at 5000 rpm, the sample was collected, and a spectrophotometer was used to calculate absorbance at 663.672 and 645 nm. The Arnon method is used to calculate the total Chl-a and Chl-b. Arnon method is basically used to determine the precise values of chlorophyll content in crops through percentage of its absorption at various wavelength's that's helpful to calculate crop indices which is used to determine the quality of crop. A wavelength of 800-400nm is used to analyse the samples in a dual beam spectrophotometer which is used to calculate the concentration and absorption through photodetector and the same has been used to calculate the chlorophyll a and chlorophyll b in crop bodies and then it is used to investigate about the crop health. Figure 1 is a model which is used to validate the results. A few components have an effect on the development and abdicate of crops e.g. the magnetised water and supplement take-up. Phytoremediation used in green plants to treat and control wastes in water, soil, and air, is an important part of the new field of ecological engineering, photosynthesis. Digestion systems are the chemical forms in plants or creatures that alter nourishment into vitality and offer assistance to them. Developing climatic changes and dry spells are fundamentally major issues in numerous zones of the

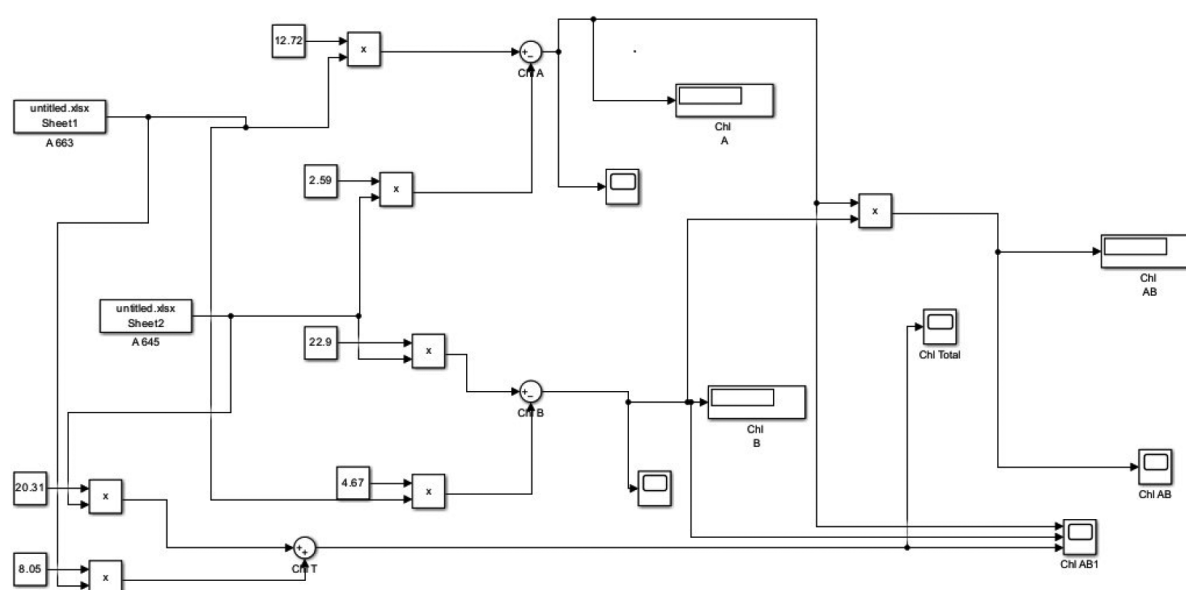


Figure 1: MATLAB model.

nation. Coastal zones indeed have saline water which can be magnetically treated and used in irrigation to save underground fresh water, overwhelming metal defilement in soil due to industrialization. It decreases its trim quality. In addition to providing a tool for resolving soil and water contamination and minimising some of the consequences of climate change on plant productivity, water magnetisation is a cutting-edge physical water treatment technique. Magnetisation's mode of action, quantum physics and chemical causes lead to hydrogen-bonded networks of water molecules enhance structural order.

On behalf of studies, applications of magnetised water on soil, water remediation and water management are examined. Magnetised water shows paramagnetic behaviour during crop treatment.

YEACI-I and YEACI-II

Yellow edge Absorption chlorophyll indices are calculated from selected wavelengths. Chlorophyll Index has been calculated by Simulink in Figure 2 and is used to evaluate the yellow index value obtained from Chl-a and Chl-b of Rice PB-06 and Basmati Rice. This has been basically cast-off to foresee the yield in case of Rice Absorption at wavelength of 663.2 nm. In the case of YEACI-I it has been calculated between the range of 3.546 to 3.54 ($P < 0.01$). Figure 2 represents the spectra for YEACI-I.

$$YEACI = \frac{A_{676.36} - A_{xi}}{A_{xi} - A_{550.507}}$$

where $A_{xi} = 663.239 \text{ nm}$, $A_{x1} = 651.232 \text{ nm}$, $A_{x2} = 645.509 \text{ nm}$. A_{x1} and A_{x2} are used to determine the values of YEACI-I and YEACI-II, respectively.

Results and Discussions

In YEACI-I at the wavelength of 651.2 nm the absorption of 0.888 to 2.619 for PB-41 and PB-06 were observed respectively. In YEACI at wavelength 645.5 nm, the absorption was 0.826 and 2.245.

Using the rice panicles' near-infrared and red-edge spectral reflectance, a graphic relationship between red-edge and near-infrared bands was created. It shows the standard deviation as we know that the UV-ViS spectrophotometer wavelength varies between 200 nm and 800 nm and behaviour has been plotted.

Table 1: Deviation in wavelength of different rice samples

| Sr No. | Wavelength in (nm) | Deviation in PB-41 | Deviation in PB-06 |
|--------|--------------------|--------------------|--------------------|
| 1 | 400-500 | 2.886 | 1.802 |
| 2 | 501-600 | 0.351 | 0.51 |
| 3 | 601-700 | 0.169 | 0.538 |
| 4 | 701-800 | 0.6 | 0.062 |

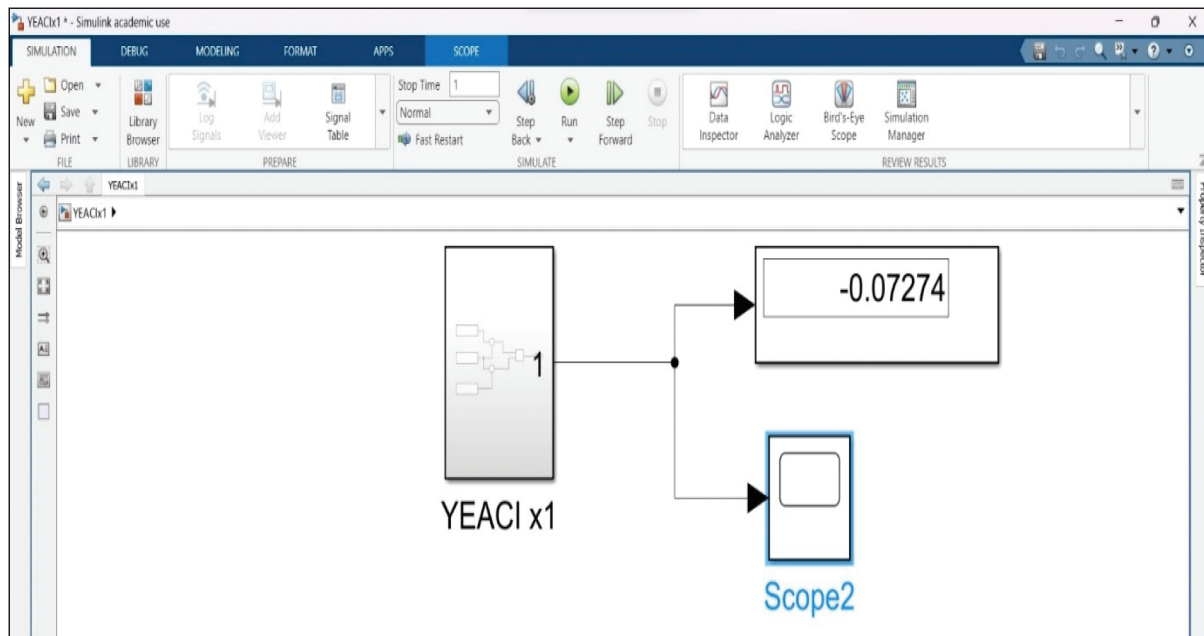


Figure 2: MATLAB simulation model for YEACI-I.

Figure 3 obtained from Table 1 shows the graphical representation of crop deviation in different samples of PB-06 and PB-41, respectively. On the other hand, Figure 4 and Figure 5 are results obtained from dual-beam UV-Vis spectroscopy. This is used to determine the absorption on different wavelengths between 400 nm to 800 nm. It has been observed that deviation in the range of 400 nm to 500 nm is more in the case of PB-41 than PB-06 samples but it is less when the wavelength is in the region of 501 nm to 600 nm. However, in the range of 601 nm to 700 nm range deviation in PB-41 is very much less as compared to PB-06. This will directly impact the Chl-a and Chl-b of crops. The immunity of magnetised rice is better in test samples.

Practical observation from Figure 6 and Figure 7 shows that when the wavelength is in the range of 701 nm to 800 nm deviation is maximum in PB-41 and is minimum in the case of PB-06. As observed that the deviation between 600 nm-700 nm and 700 nm-800 nm is maximum in the case of Pb-06 samples instead of PB-41 samples, It shows that the immunity of PB-06 is more than PB-41 samples. The observations are based on Arnon methodology that is used to represent the precise values along with lambda maximum for each crop. The use of pesticides has been reduced which is helpful in order to reduce environmental pollution oil and water contamination after treatment it has been observed that it reduces by 2 folds in each crop. The high yield is achieved which increases from

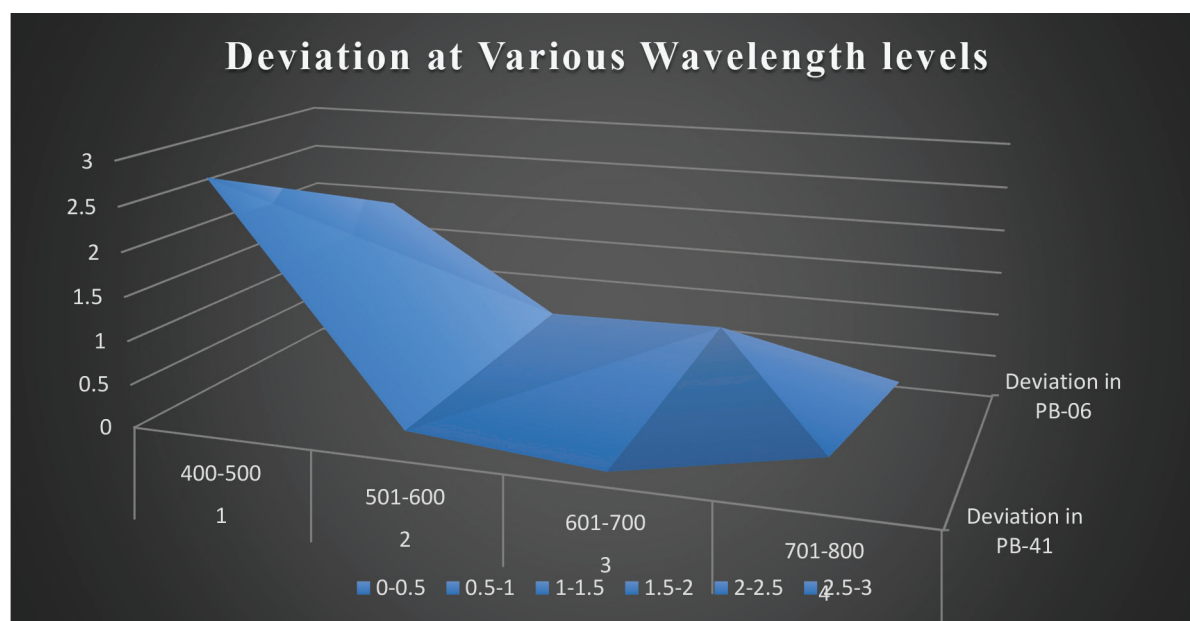


Figure 3: Graphical representation of deviation in PB-06 and PB-41 samples.

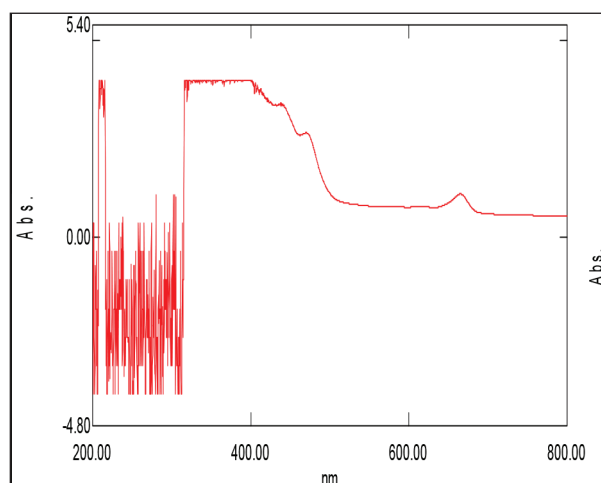


Figure 4: PB-41 wavelength vs absorption.

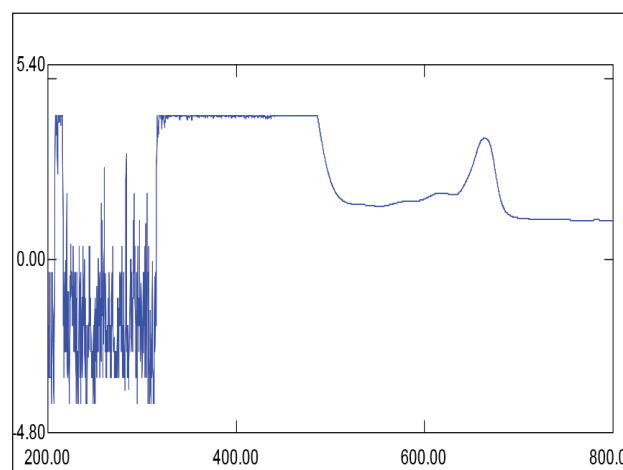


Figure 5: PB-06 wavelength vs absorption.

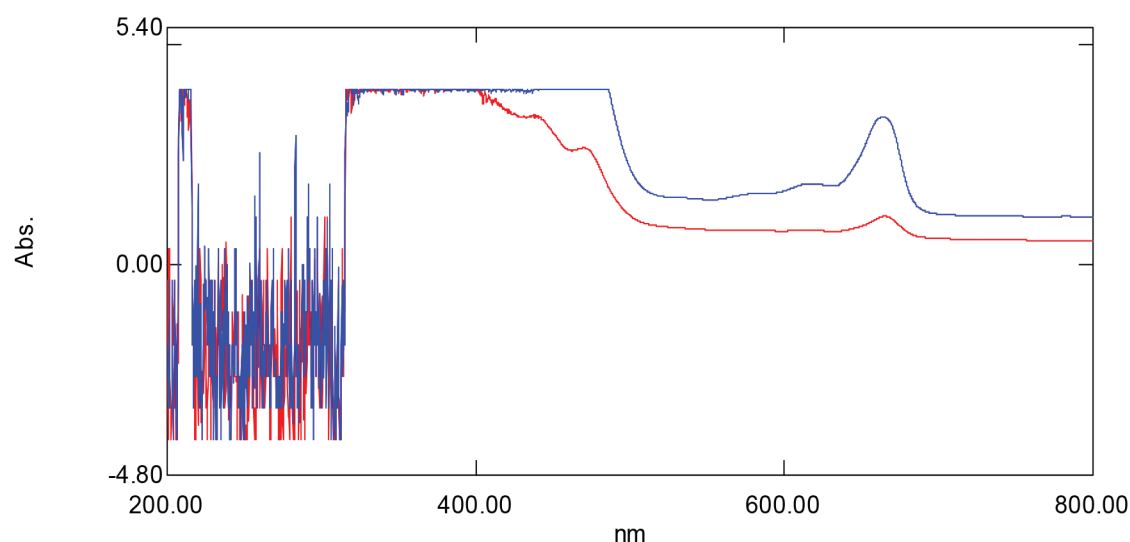


Figure 6: Optimisation of absorption at visible and UV regions for PB-06 and PB-41.

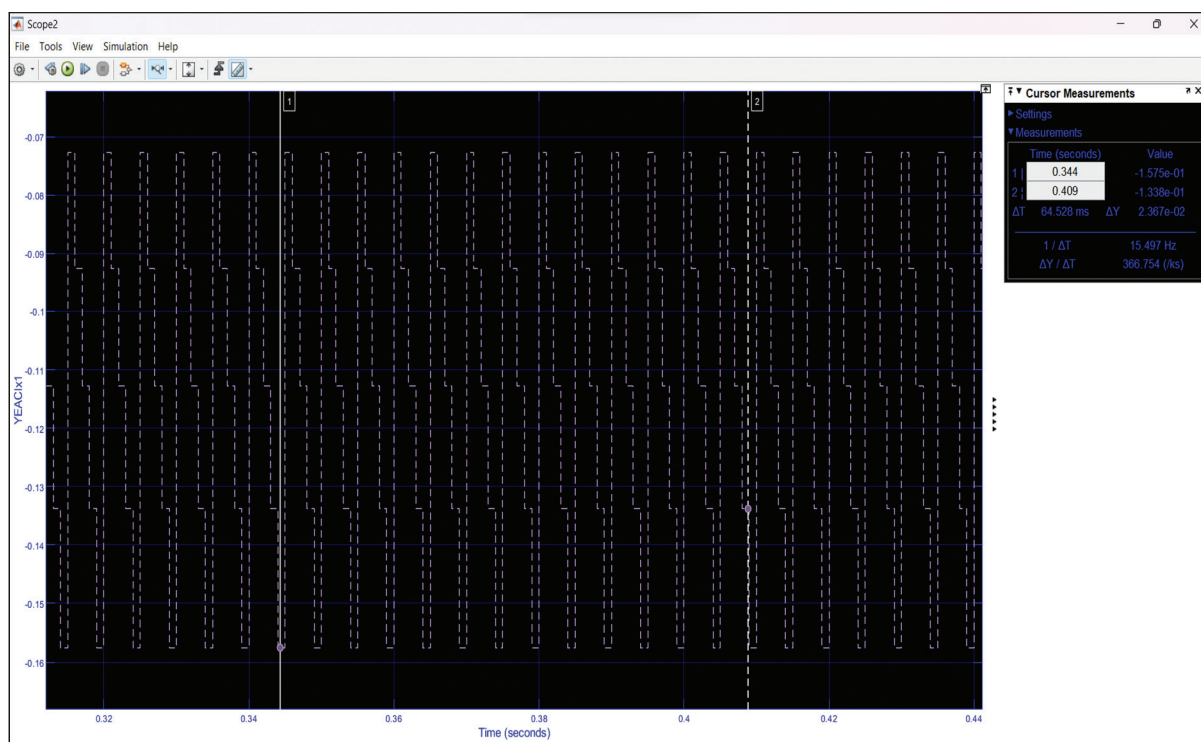


Figure 7: YEACI-I in crops (rice).

4% to 8% per hectare. Figure 3 shows the crop index YEACI which is calculated and shown in terms of time deviation.

In the case of PB-41 maximum wavelength is available at 600.4 nm and it shows an absorption of 0.763. On the other hand in PB-06 absorption is 1.677 so the maximum wavelength is available at 600.2 nm. The immunity of PB-06 is more but diseases e.g. blight and tillering effects are less in PB-06 samples.

Chlorophyll-a and chlorophyll-b can also be evaluated from absorption values at different wavelengths. It has been observed from absorption spectra that PB-06 has better immunity and yield comparatively.

It has been observed that the stability in PB-41 characteristics is more at the higher range of wavelength but it is comparatively less in PB-06 samples. Other methods can also be adopted for the determination of chlorophyll e.g. Satellite mapping, SPAD meter and

Hyperspectral imaging but those methods are less accurate comparatively.

From research of the above samples it has been observed that deviation in PB-06 is more but stability in PB-41 is better as from the above experimentation. As observed from Figure 10, $\Delta T = 603.388 \text{ ms}$ and the time deviation is 4.705 and 5.309. Figure 8 and Figure 9 represent deviation and enhancement in root lengths of PB-06 and PB-41. Figure 10 is the YEACI-II model and spectrum at a particular WL region.

As concluded that the root length of treated samples is greater in both PB-06 and PB-41 samples when optimised with untreated samples. It leads to better crop health and immunity in order to obtain better yield quality and yield which varies between 3% to

6%. Due to improved root length tillering, the effects of rust and other diseases will be decreased in treated samples. Healthy crops require less number of pesticides to survive and that's good for the health of humans. But timely use of fertilisers is required. The technique adopted in this case is environment friendly which reduces the use of urea as well as pesticides in crops. Figure 11 YEACI_{x2} represents preshoot is 0.505%, overshoot is 0.505% and undershoot is -0.505%. Maximum peaks are 3 in this case. As discussed above the magnetically treated samples require less amount of urea and less pesticides for rice which leads to environment friendly. Less urea means less soil pollution and less pesticides means healthy crops with nutritional values. PB-41 root length rises by 3-13%,

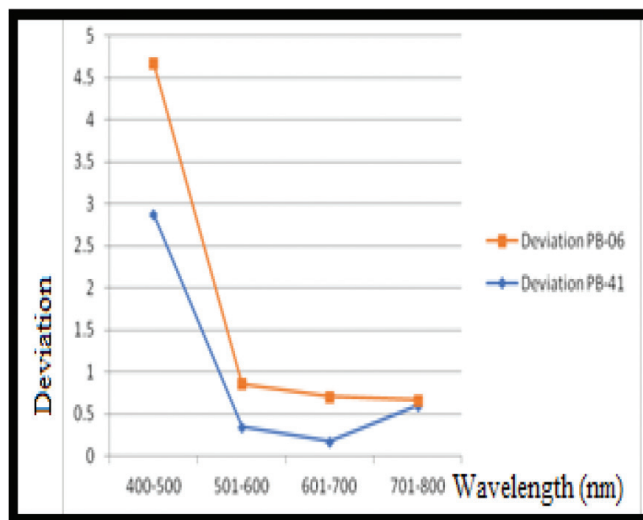


Figure 8: PB-06 Vs PB-41 deviation at root length different wavelengths.

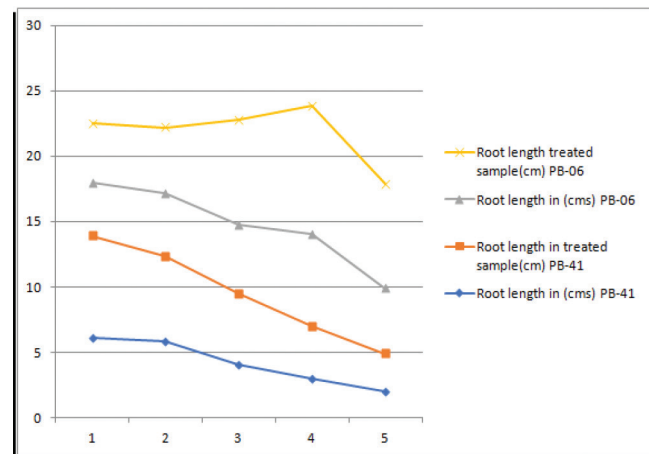


Figure 9: PB-06 vs PB-41 enhanced in magnetically treated samples.

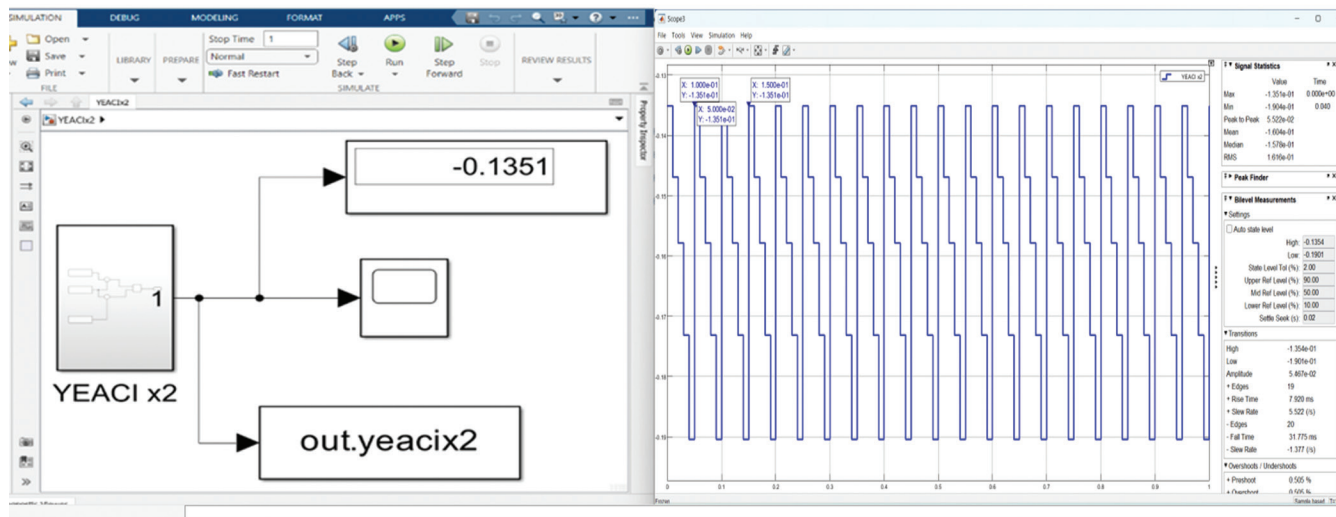


Figure 10: Crop Index YEACI-II by using MATLAB.

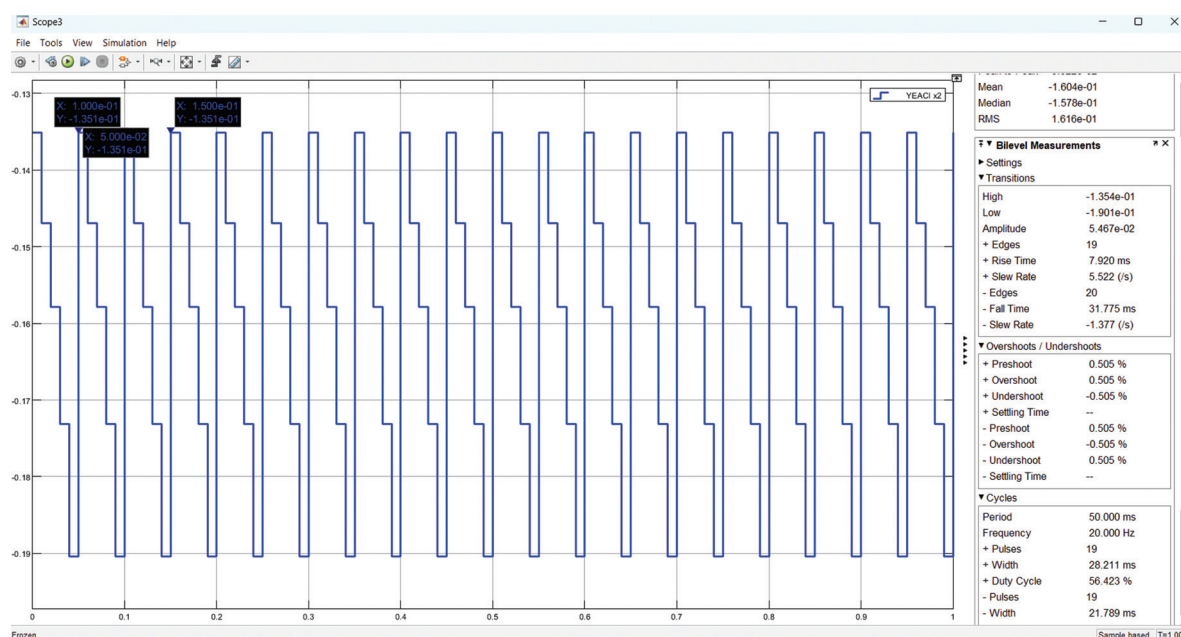


Figure 11: Crop Index YEACI-II.

average value is about 8% and PB-06 root length rises by 4-17.5%, average value is about 15%. It has been observed that in the analysis almost 3-5% boost/regulation in chlorophyll level has been achieved in test samples of both PB-41 and PB-06. As concluded that root length of treated samples is more in both PB-06 and PB-41 samples when optimized with untreated samples. It leads to better crop health and immunity in order to obtain better yield quality and yield which varies between 3% to 6% through magnetic priming and it reduces the use of pesticides and is ecofriendly. Similar analysis can be achieved in other crops e.g. average height of DBW-187 is 106.2 instead of 104 cm and it requires 149 days instead of 153 days to ripe which gives better yield 23.2 which is boosted from 22.6 quintal per acre in Punjab (Improvement is 2.6-3.5%).

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