Investigating Impacts of Hyper Gravity on Fully Imbibed Seed of Wheat and Analysis of Absorption Peaks of Chlorophyll A and B, Percentage of Germination, Weight of Fresh and Dry Shoot, Root, and Percentage of Chlorophyll

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Abstract

The purpose of this experiment was to observe the effects hyper gravity on the germination, growth, and development of seeds. This report deals with the calculation of gravity, its effects on growth of seeds, chlorophyll content and changes in absorption peaks as obtained from the spectrophotometer. Higher g value stimuli (gravitational acceleration more than 1 g and referred as hyper gravity) caused by centrifugation has been shown to inhibit elongation growth of various plants. In the present study effects of high g values were studied on wheat seeds exposed to high g values ranging from 100 g to 1300 g for 15 min and grown under normal environmental conditions. After chlorophyll extraction, the extract was used to study the absorption spectra using UV-Visible spectrophotometer. Results obtained show decrease or increase in growth and chlorophyll content in wheat, seedlings. The detailed investigation is included in this paper.

***Keywords**: Hyper gravity*

Introduction

Every planet has its own gravitational field by which physical bodies attract each other with a force proportional to their respective mass and inversely proportional to the square of the distance between them. Every planetary body is surrounded by its own gravitational field, which in turn exerts an attractive force on all objects. The strength of the gravitational field on the Earth's surface is given as a form of acceleration corresponding to 9.81 meters per second squared (m/s2) and is often expressed as "1 g". An acceleration force larger than 1 g is called hyper gravity. It can be generated in a laboratory by means of a centrifuge machine. This is an experiment to study hyper gravitational effects on imbibed seed of wheat and after germination chlorophyll content and changes in absorption peaks as obtained from the spectrophotometer

Experimental and Methods

The methodology includes selection of wheat samples, sample collection with treatment and instrumentation used in the study. Wheat seed kept in distill water for 24 hours to soak the water and

after 24 hours we give the effect of hyper gravity on Fully imbibed grain just before the embryo emerges for 15 minutes ranging from 1000 rpm 2000 rpm and 3000 rpm that result increase in gravity 134.16g, 536.64g & 1207.44g receptively by means of laboratory centrifuge machine and After planting the grain quickly in agar-agar jell the processes of germination start. After 7 days, plants were taken out of the agar-agar jell, and measurements were taken.

Centrifuge machine

We use laboratory centrifuge machine in this study which is digital and display revolution per minute i.e. RPM and Ultraviolet–visible spectroscope to calculate Absorbance.

Sample collection with treatment

Native plant species like wheat that will be appropriate for the study chosen are native species that match restoration site conditions and the three most important variables for plants: weather, light, and temperature availability**.** After 7 days, plants were taken out of the agar-agar jell, and measurements were taken. The plants in the hyper gravity environments, groups,1000 rpm, 2000 rpm &3000 rpm experienced adverse effects from the hyper gravity environment. Compared to the normal condition

Fig. 1 prepared of agar gel

Fig. 2 Photo snap of plant in agar

Instrumentation

After 7 days, plants were taken out of the agar-agar jell, and measurements were taken. The plants in the hyper gravity environments, groups,1000 rpm, 2000 rpm &3000 rpm experienced adverse effects from the hyper gravity environment. Compared to the normal condition

Fig. 3 laboratory centrifuge machine

Fig. 4 UV-Visible spectrophotometer

Chlorophyll extraction

Chlorophyll extracted in 80% acetone from a green leaf appears green. The chlorophyll extract can vary in the depth of green or tint of green depending on the plant material from which it was extracted. In Angiosperms (most land plants) there are typically two types of Chlorophyll (Chl) molecules, namely, chlorophyll *a* (Chl*a*) and chlorophyll *b* (Chl*b*). Both of these pigments absorb photons of light in the blue and red spectral regions, but the specific wavelengths of light they absorb are different. The absorbance of photons at 663 nm and 645 nm, specific for Chl*a*
Arnon's equation (below) to convert absorbance measurements to mg Chl g-1 leafTissue

Calculations

1 Chl a (mg g-1) = [(12.7 × A663) - (2.6 × A645)] × ml acetone / mg leaf tissue

2 Chl b (mg g-1) = [(22.9 × A645) - (4.68 × A663)] × ml acetone / mg leaf tissue

[Chls$a$ + b] = 20.21·E645 + 8.02·E663

Total Chl = Chl a + Chl b.

Results and Discussion

Change in gravity

Higher g value stimuli (gravitational acceleration more than 1 g and referred as hyper gravity) caused by centrifugation.

Table 1: RPM (revolution per minutes) to RCF (relative centrifugal force) i.e. change in gravity Percentage of germination.

Sr .no	Seed	Rotational speed revolutions per minutes	Change in gravity (RPM TO RCF = g)
1	wheat	1000 RPM	134.16
2	wheat	2000 RPM	536.64
3	wheat	3000 RPM	1207.44

Wheat seeds germinated 60% at normal condition , at 1000 rpm 73%, and for 1000 and rpm ,2000 rpm it is 80% , 66.66% respectively.

Table 2: Percentage of germination.

Sr. no	Condition	No of seed germinated	Percentage of germination
1	Normal condition	9	60%
2	1000 rpm	11	73%
3	2000 rpm	12	80
4	3000 rpm	10	66.66%

Fresh and dry weight of shoot and root

There is a large variation in weights of fresh and dry shoot and root seed wich is affected by hyper gravity

Table 3: Fresh and dry weight of shoot and root.

Sr. no.		Normal wheat Weight		1000 wheat Weight		2000 wheat Weight		3000 wheat Weight	
		Fresh	Dry	Fresh	Dry	Fresh	Dry	Fresh	Dry
1	Leaf	0.595	-	0.854	-	1.312	-	400	-
2	Shoot	0.311	0.17	6.60	1.2	1.104	0.43	1.93	0.63
3	Root	2.90	0.8	4.038	0.84	2.965	0.49	3.50	0.43

Calculation of Chlorophyll

Table 4: Variation in Chlorophyll for different conditions.

Sr. no.	Condition	Total Chlorophyll Mg/g tissue	Chlorophyll a Mg/g tissue	Chlorophyll b Mg/g tissue
1	Normal condition	0.9305	0.5025	0.4282
2	1000 rpm	1.1432	0.7302	0.4134
3	2000 rpm	0.9861	0.608	0.3784
4	3000 rpm	1.0360	0.6523	0.3839

Root and shoot no of secondary rood

Table 5: Measurement of Root and shoot length in cm & no of secondary rood.

Normal				1000			
Sr. no.	Shoot length	Root length in cm	No. of secondary root	Sr. no.	Shoot length	Root length in cm	No. of secondary root
1	3.5	10.5,,7,8.3,2,3,4	12	1	3	9,8,3.4,2.1	6
2	4.5	6,7.6,7.2,4	10	2	2.3	8.3,6.2,3	4
3	4.6	12,10,7,9.8,4	6	3	3	9,8.7,7.2,5,3	8
4	3.2	9,7.8,7,5.3	8	4	3.7	14.7,5.3,8.9,2.8	14
5	3	7,5,3.2	4	5	3.2	14,10.7,2.4,4.5	12
6	2	14,7,9,4.6	18	6	3.4	12.8,4.5,11.4,2.3	10
7	2	3,2.8,4.3	2	7	3.6	14.8,9.7,4.7,11.2	16
8	2.8	10,9,7.4,7,4	8	8	3.2	10.2,12.3,4,5.6	5
				9	3	10.9,2.3,5,2.8	2
				10	3	13,10.9,2.4,3.9	8
				11	3.4	6,12,3.4	4

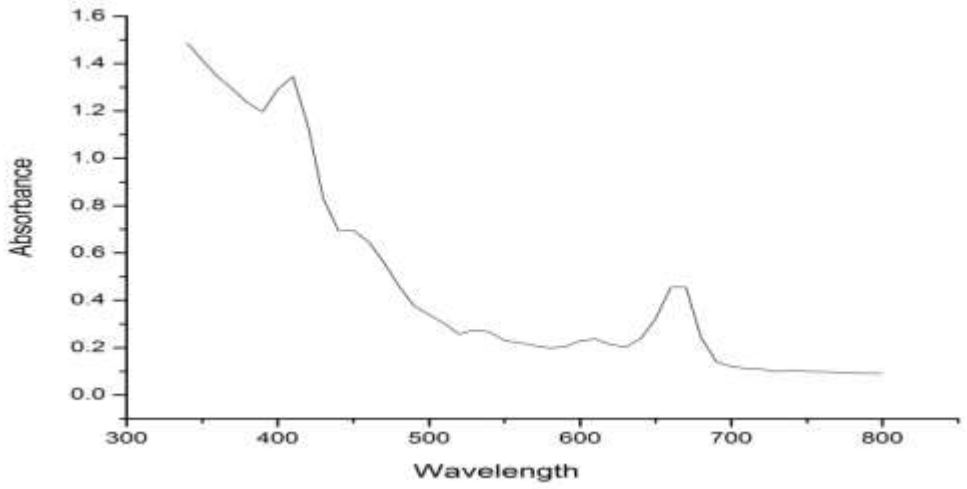
Root and shoot no of secondary rood

Table 6: Measurement of Root and shoot length in cm & no of secondary root

2000 rpm wheat sample					**3000 rpm wheat sample**		
Sr. no.	**Shoot length**	**Root length**	**No. of secondary root**	**Sr. No.**	**Shoot length Root length**		**No. of secondary rood**
1	4	3.5,2.5,7,2	8	1	3	8.5,3.3,4.2	4
2	3.5	12.8,12.7,10,4.5	6	2	2	14,13,11,6.5,9	18
3	3	7,8.2,2	2	3	3.2	9.7,5.5,4.5,2.3	12
4	3.5	8.5,3,7.3,4	7	4	3	10,12.3,14,4	20
5	4.3	12.3,10,11.9	10	5	2.8	10,9,8,5,2	8
6	3.6	11,10.9,8.7	11	6	2.3	11.2,7.2,3.7	10
7	3.4	11.2,8.7,3.4	14	7	3.4	6.5,914,13	8
8	3.3	12.5,8,7,4.6	16	8	3	12,10.2,2.8,3	14
9	3	15,6,8,4	18	9	2.4	8,4,5,2	2
10	3.5	9,5,4,4.6	11	10	2.9	6.7,3,2	6
11	3.3	12,7,4,8	8				
12	3.6	9,8.7,6.7	6				

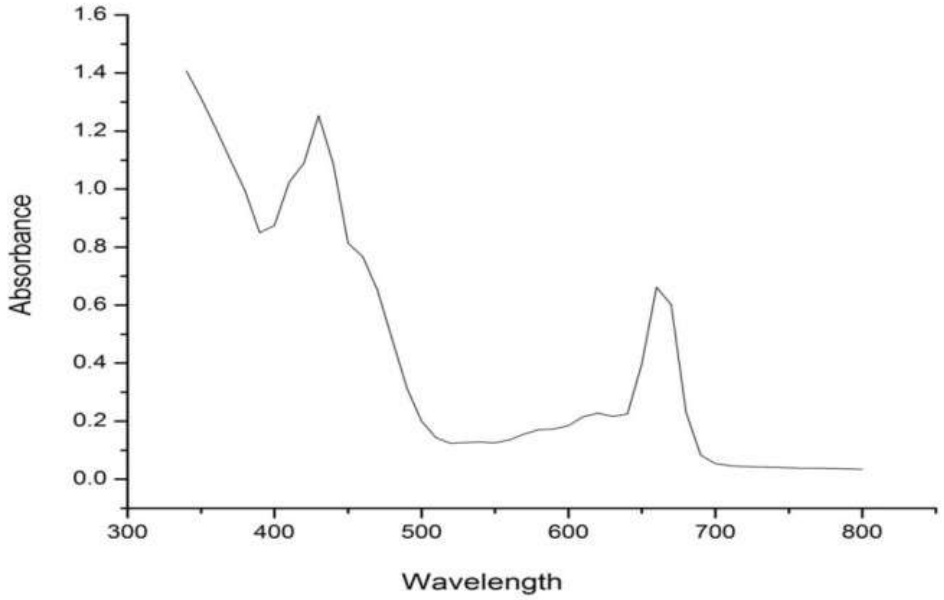
Absorbance

Graph 1 of normal group group absorbance vs. wavelength ranging from 300 to 800 nanometers



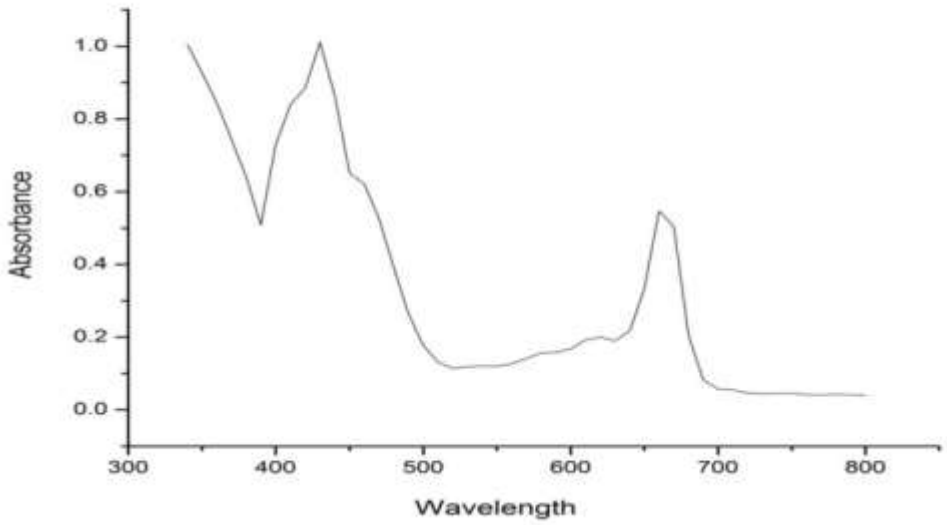
First peak is at 410 nm at 1.36 absorbance unit indicates chlorophyll b & Second peak is at 660 nm at 0.455absorbance unit indicates chlorophyll a

Graph 2 of 1000 rpm group absorbance vs. wavelength ranging from 300 to 800 nanometers



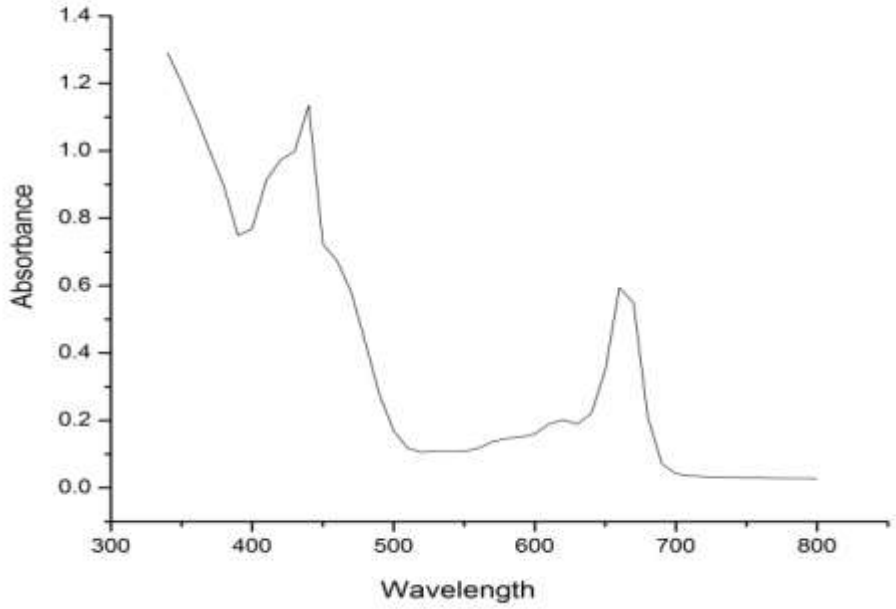
First peak is at 430 nm at 1.254 absorbance unit indicates chlorophyll b&Second peak is at 660 nm at 0.455 absorbance unit indicates chlorophyll

Graph 3 of 2000 rpm group absorbance vs. wavelength ranging from 300 to 800 nanometers



First peak is at 430 nm at 1.011 absorbance unit indicates chlorophyll b& Second peak is at 660 nm at 0.547absorbance unit indicates chlorophyll a

Graph 4 of 3000 rpm group absorbance vs. wavelength ranging from 300 to 800 nanometers



First peak is at 440 nm at 1.135 absorbance unit indicates chlorophyll b Second peak is at 660 nm at 0.594 absorbance unit indicates chlorophyll a

Conclusions

Percentage of germination

Form above data we are conclude that In wheat percentage of germination of seed is varied for different conditions i.e. percentage of germination is increased with increasing gravity and for 2000 RPM (536.64g) it is very high

Fresh and dry weight of shoot and root

Form this study we can conclude that the effect of hyper gravity is not only chlorophyll but also on the weight of shoot, root at condition of fresh and dry

Calculation of Chlorophyll

Total Chlorophyll (Total Chl = Chl a + Chl b.) in the wheat also show variation overall it is increased it means that the photo synthesis rate also increased

Absorbance

Absorption spectra showing how the different side chains in chlorophyll a and chlorophyll b result in slightly different absorptions of visible light with a wavelength of 460 nm is not significantly absorbed by chlorophyll a, but will instead be captured by chlorophyll b, This absorbs strongly at that wavelength. The two kinds of chlorophyll in plants complement each other in absorbing sunlight. Plants are able to satisfy their energy requirements by absorbing light from the blue and red parts of the spectrum. However, there is still a large spectral region between 500 and 600 nm where chlorophyll b absorbs very little light, and plants appear green because this light is reflected.

Table Values of first and second peak in absorption spectra

Seed	RPM	First Peak		Second peak	
		Wavelength	Absorbance	Wavelength	Absorbance
wheat	Normal	410	1.346	660	0.455
	1000	430	1.254	660	0.662
	2000	430	1.011	660	0.547
	3000	440	1.135	660	0.594

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