iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 5 **Issue:** X **Month of publication:** October 2017

DOI: http://doi.org/10.22214/ijraset.2017.10005

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:6.887
Volume 5 Issue X, October 2017- Available at www.ijraset.com

Comparative Analysis of Effect of Heavy Metals (CD &PB) on Morphometric Characters of rice (Oryzasativa l), Variety IR-36 from Lower Genetic Basin, W.B., India

Nilay Nath Banerjee[1], Dr. Sudipta Kr. Sil[2]
[1,]*Research Scholar (NET & SET Qualified), Dept. of Botany, University of GourBanga, WB, India*[1]
[2]*Associate Professor &HOD of Botany, University of GourBanga, WB, India*[2]

Abstract: Plants can't move away and are therefore continuously confronted with un-favourable environmental conditions (i.e. Different kind of biotic& abiotic stress). Effect or impact of heavy metals (i.e. Heavy metal stress) on agricultural crops is a growing concern of recent times. Heavy metals affect different parameters of plant growth, morphology, plant physiology & biochemistry. But out of this, effect on different morphometric characters (i.e. Plant height, no. Of tiller, length & breadth of leaves, panicle length & weight) are clearly visible & easy to asses. Ir-36 a very popular and high yielding rice variety to Indian farmers artificially treated with successive grades of CD (cadmium sulphate) & PB (lead nitrate) salt in field condition from 45 booting stage. Then data of different morphometric parameters were randomly taken and statistically processed just before the senescence of leaf. Comparison of this data with the controlled or unaffected plant shows a gross reduction or downfall at every parameter or morphometric character. Effect of cadmium (cd) is more devastating than lead (pb).
Keywords: Heavy metals (cd &pb), heavy metal stress, ir-36, morphometric characters.

I. INTRODUCTION

'Heavy Metals'(HM) is a general collective term, applies to the group of metals and metalloids with atomic density greater than 4 gm/cm^3 or 5 times than water (*Hawkes, 1997*). Among a variety of heavy metals Cd &Pb are more common in environment (*Mukti Gill, 2014*) due to several natural as well as anthropogenic factor and focussed in our studyhere.Usually the levels of heavy metals in agricultural soil are very low (apart from the site adjacent to mine or volcanos). But continuous applying of different kinds of chemical fertilizers (mainly Nitrogen &Phosphate containing fertilizer) increase its amount as different heavy metals viz. – Cd, Pb, Hg remains as impurity of it (*Raymond Wuana& Felix, 2011*)besides this application heavy metal containing (viz. Pb, As, Cu) pesticides are one of the major source of heavy metals in agricultural field (Ross, 1994). According to *Yanqunetal 2005*, Cd enrichment occurs due to the application of sewage sludge. Continued irrigation, unavoidable part of agricultural practice now, also lead to accumulation of heavy metals such as Pb& Cd (*Ross, 1994 & R K Rattan, 2005*).

Apart from all of this, rapidly increasing automobile rush & energy supplying power stations such as coal burning power plants became a major threat by emitting a great amount of Pb& Cd in atmosphere (Verkeleji, 1993).

Heavy metals as a whole acts as a growth inhibitor by hampering chlorophyll biosynthesis as well as photosynthesis, obstacle the activity of plant growth regulator (IAA) and uptake of nutrition (N, P, K, Ca, Mg) & water. Hence stunted or reduced growth of both root & shoot (i.e. steam) region is very common. According to Raziuddin et al. 2011, Cd cause disturbances in chloroplast metabolism by inhibiting chlorophyll biosynthesis and reducing the activity of enzymes involved in CO2 fixation. Lead (Pb) is also known to affect photosynthesis by inhibiting activity of carboxylation enzymes (Stiborova et al. 1987). Lead induced stimulation of indole-3.Acetic acid (IAA) oxidation.

Heavy metals also interfere with the branching pattern of the Rice. Leaf area particularly the flag leaves of crop plant plays vital role in photosynthesis. Heavy metals have a negative impact upon this. As photosynthesis is hampered by heavy metals, it also interfere the biomass production & yields of crop plant which is reflected panicle size & weight of cereal crop.

Like other plant rice also affected by heavy metals in the same way. IR-36 a high yielding rice variety developed by IRRI (IR-36 - the world's most popular rice by IRRI) widely distributed throughout the country and popular to cultivar, selected to asses this

impact. Because rice is one of the principal staple food as well as cash crop our country (The Rice economy of Asia - Randolph Barker et al) andGangetic basin is the heart-land of rice cultivation.

This research article have organized as follows. Section II describe methodology related to the salt treatment at field condition and morphometric data collection & analysis. After that Section III represent experimental result showing different table & figure. Finally Section IV present conclusion.

II. MATERIAL & METHODS/ RELATED WORK

A. Study area

West Bengal is one of the highest rice yielding (No. 1 in Rank) state in India. Dist. Burdwan is known as 'Paddy Farm' of West Bengal. MouzaRasui under Ketugram-II block of the Burdwan district (Latitude: 23.71^0N, longitude 88.04^0E and Altitude 22 M) in the bank of river Ajay is consider as experimental site.

B. Treatment Protocol & Duration

Prior to this experimental work it was confirmed by soil sample testing of identified agricultural plot, that it is free from any kind of heavy metal contamination (Particularly Pb& Cd). Both Cd (Cadmium sulphate) &Pb (Lead nitrate) are artificially supplied in a regular interval at four concentrate gradient of 50, 100, 150 & 200 ppm throughout the Boro season of paddy (Feb'17 – April'17) from 45 days booting stage to onset of flowering. A number of 2' x 2'plot were set up in agricultural land in this regard where salt of definite concentration were applied.

C. Observation & Data Collection

After 60 days of artificial salt treatment different pre-definite morphometric data are collected in a random fashion from different treated & controlled plant.

D. Morphological Parameter Analysis

(i) Length of Root,(ii) Length or height of stem,(iii) No. of tiller,(iv) Length of flag leaves,(v) Breadth of flag leaves, (vi) Leaf surface area,(vii) Length of panicle,(viii) Weight of panicle.Thiseight morphological parameters were consider in our study.

E. Statistical Method

Application of statistics to determine the mean of the randomly collected sample data (10 individuals from each) and variance from this mean i.e. Standard Deviation (SD) has also done. It will make the impact or outcome of the study more accurate & practical & devoid of chance factor.

III. RESULTS & DISCUSSION

Table – 1: Effect of Heavy Metal (Cd) on different Morphometric characters of Rice variety (IR – 36)

Sl. No.	Morphometric Character	Cadmium Sulphate ($CdSO_4$, $8H_2O$)				
		0	50ppm	100ppm	150ppm	200ppm
1	Root Length (cm)	18 ±1.76	17 ±1.33	15 ±1.66	13 ±1.58	11 ±1.54
2	Shoot/ Steam Length (cm)	96 ±1.71	88 ±1.75	86 ±1.27	83 ±1.69	80 ±1.83
3	No. of Tiller	14 ±1.5	13 ±1.6	12 ±2.0	10 ±1.7	8 ±2.0
4	Length of Flag Leaves (cm)	25 ±1.25	23 ±1.36	21 ±1.5	20 ±1.31	19 ±1.11
5	Breadth of Flag Leaves (mm)	14 ±0.78	14 ±0.91	13 ±1.08	12 ±0.73	11 ±0.67
6	Leaf Surface Area (cm^2)	35	32	27	24	21
7	Length of Panicle (cm)	23 ±2.01	21 ±1.97	19 ±1.71	17 ±1.31	16 ±1.50
8	Weight of Panicle (gm)	3 ±0.56	2.3 ±0.20	2.04 ±0.35	1.90 ±0.52	1.71 ±0.37

From the above data it is clear that Cadmium (Cd) have an adverse effect on each & every morphometric parameter. Impact of it's maximum on Root Length and minimum on Breadth of Flag Leaves.

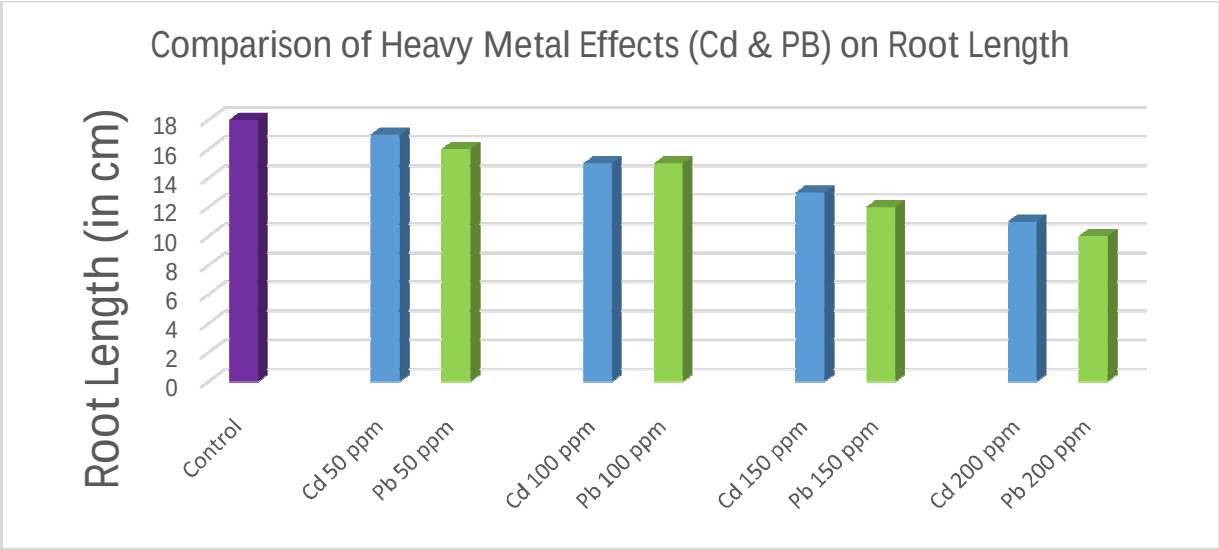
Table – 2: Effect of Heavy Metal (Pb) on different Morphometric characters of Rice variety (IR – 36)

Sl. No.	Morphometric Character	Lead Nitrate				
		0	50ppm	100ppm	150ppm	200ppm
1	Root Length (cm)	18 ±1.76	16 ±1.50	15 ±1.49	12 ±1.08	10 ±1.15
2	Shoot/ Steam Length (cm)	96 ±1.71	95 ±2.04	94 ±1.94	88 ±1.80	84 ±1.72
3	No. of Tiller	14 ±1.5	13 ±1.4	11 ±1.5	9 ±1.3	8 ±1.3
4	Length of Flag Leaves (cm)	25 ±1.25	24 ±1.95	22 ±2.06	21 ±1.63	20 ±1.82
5	Breadth of Flag Leaves (mm)	14 ±0.78	14 ±0.91	13 ±1.08	12 ±0.75	12 ±0.65
6	Leaf Surface Area (cm^2)	35	34	29	25	24
7	Length of Panicle (cm)	23 ±2.01	22 ±1.88	20 ±1.79	19 ±1.76	17 ±1.50
8	Weight of Panicle (gm)	3 ±0.56	2.37 ±0.64	2.16 ±0.51	2.14 ±0.33	1.96 ±0.50

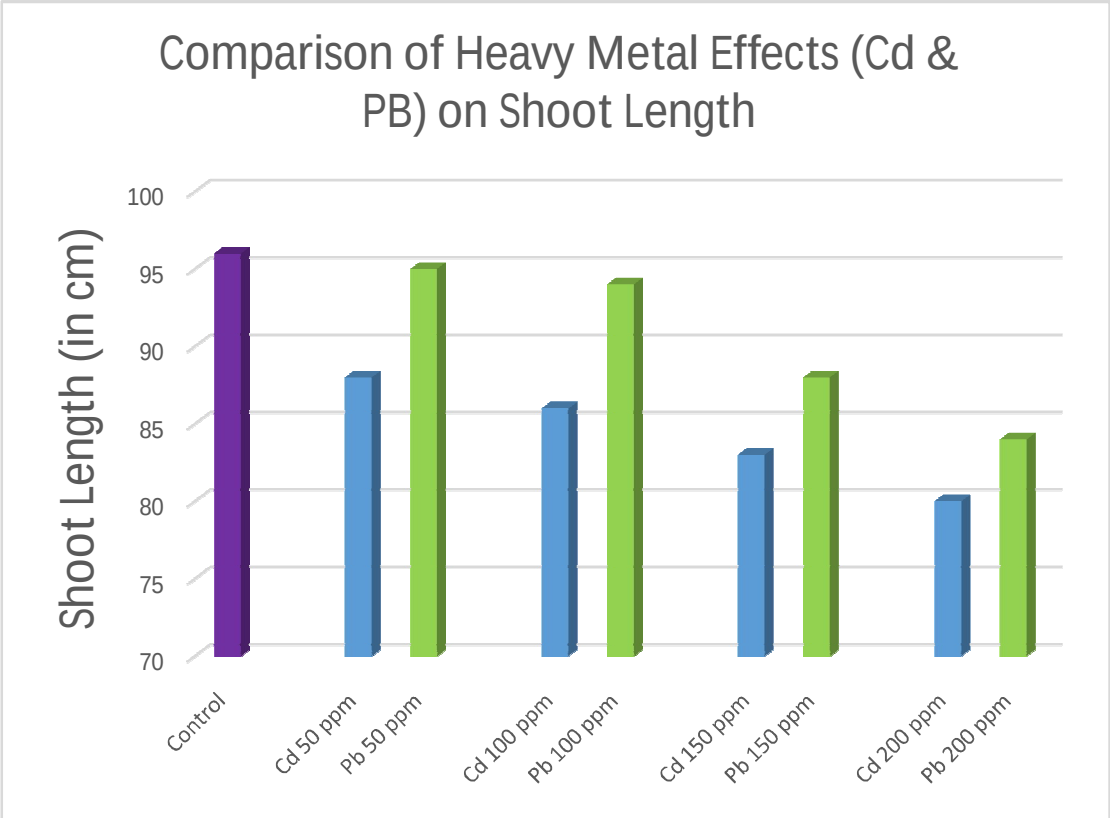
It is apparently clear that heavy metals (Both Cd &Pb) have a negative impact on all morphological parameters. There is a tendency of downfall of the value with the gradual increase of salt concentration. The effect of Cd is more severe than Pb (except the Root elongation).

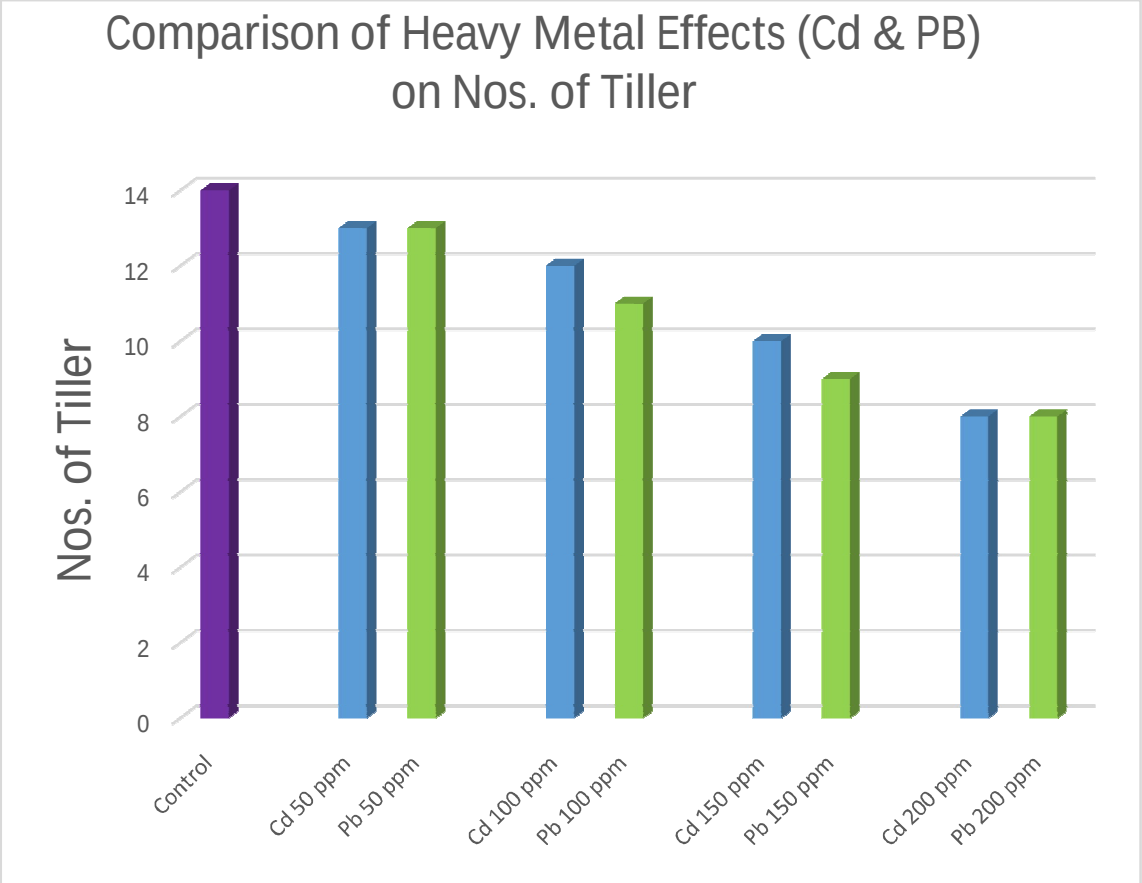
IV. CONCLUSION

Results of chlorophyll estimation reveals that effect of Cd in this regard is severe than Pb. Most probably it is due to the concentration gradient of the salt (Cd &Pb) which have applied in this experiment. Because degree of tolerance of Pbconcentration(up to 170 mg/ kg equivalent to 170 ppm,Saha J. K, 2010) is many fold greater than Cd (5 to 10 ppm, S. Gill). Though the effect on chlorophyll-a / chlorophyll-b ratio is same in both the cases (Cd &Pb).

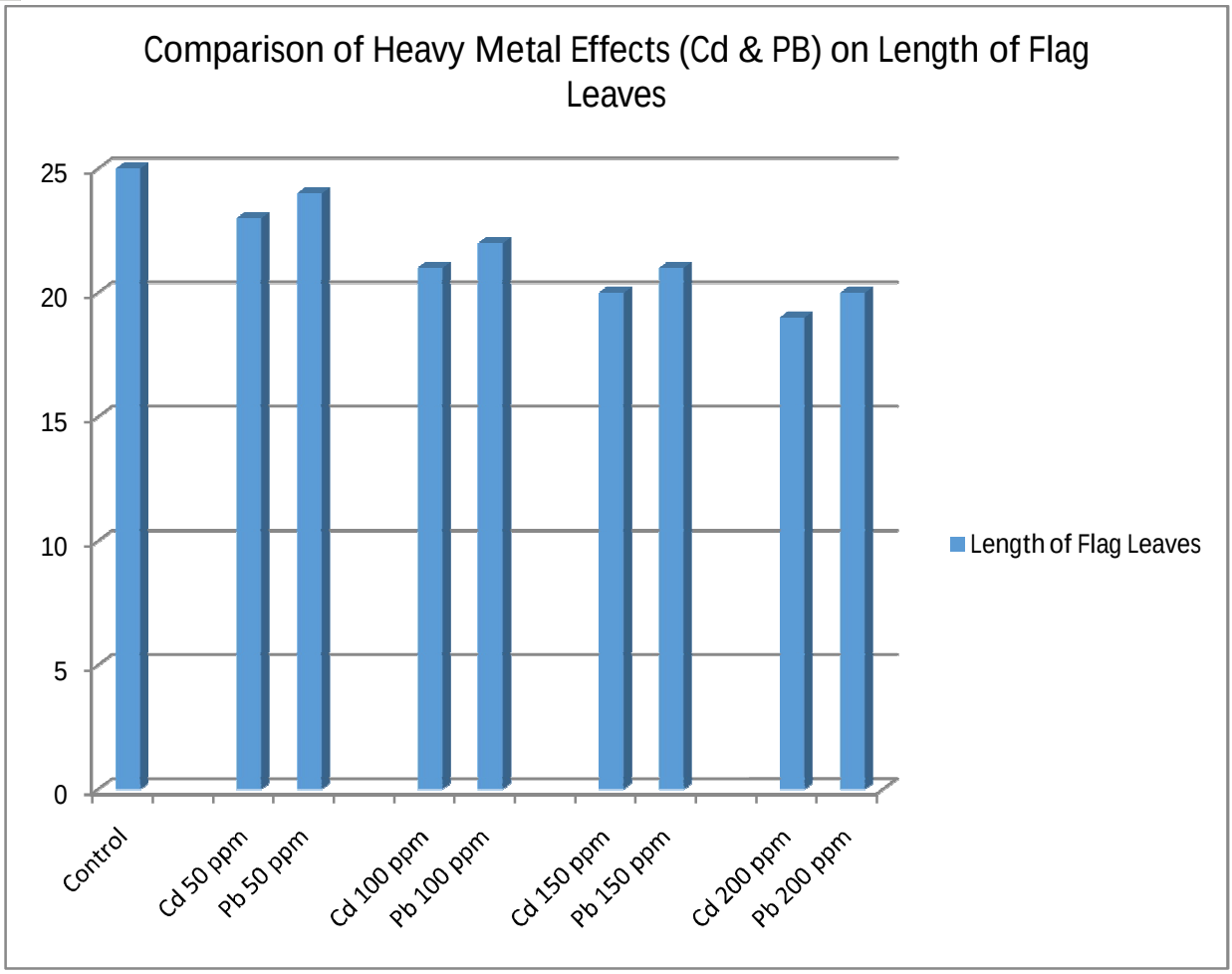


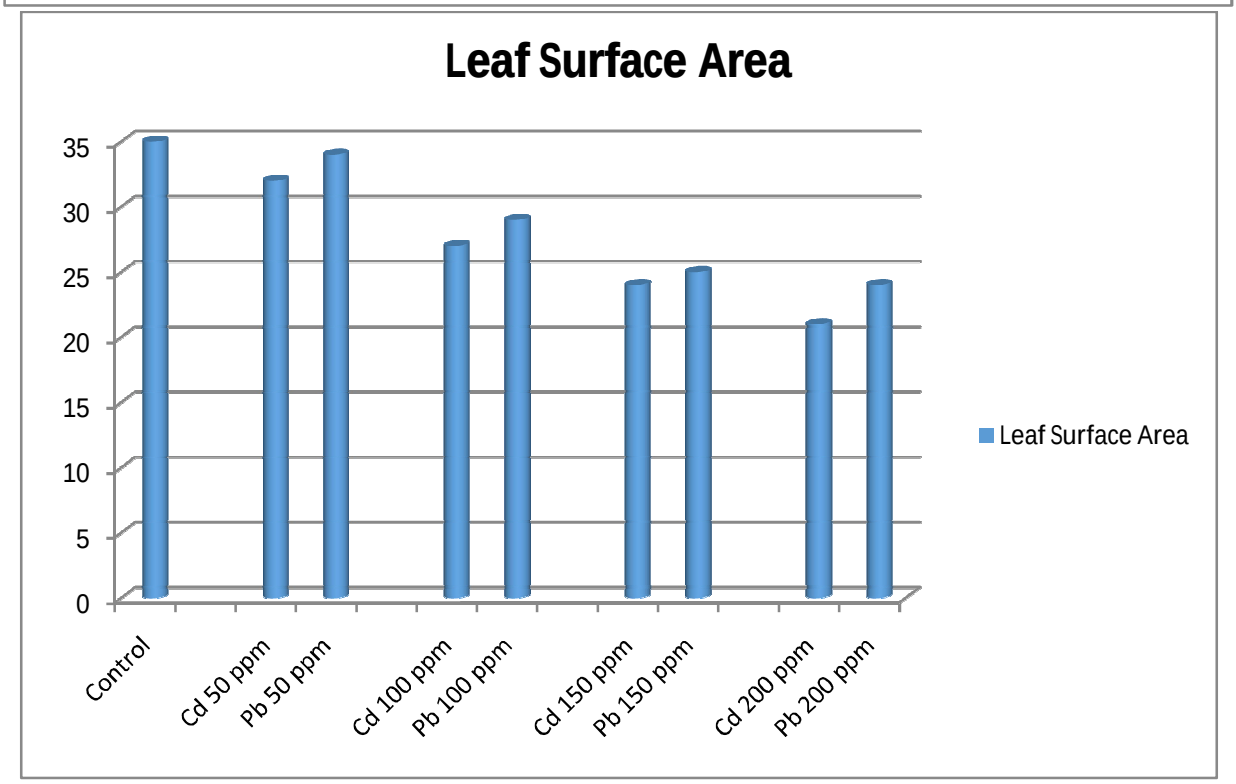
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:6.887
Volume 5 Issue X, October 2017- Available at www.ijraset.com

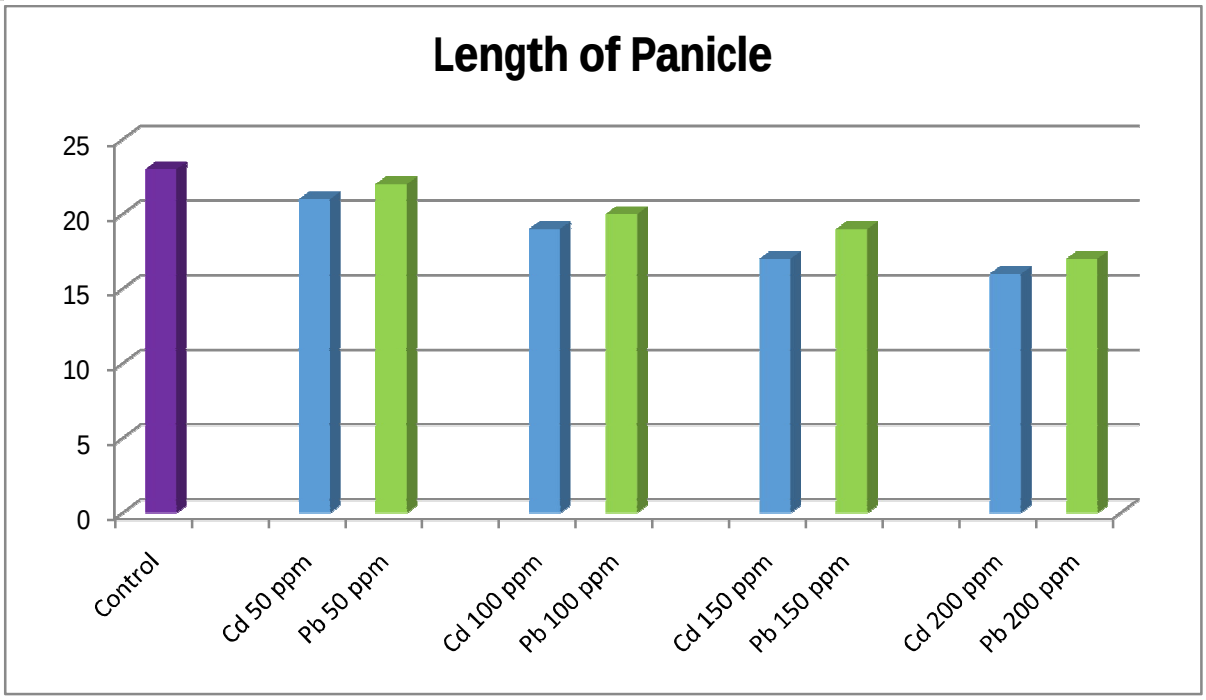




ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:6.887
Volume 5 Issue X, October 2017- Available at www.ijraset.com

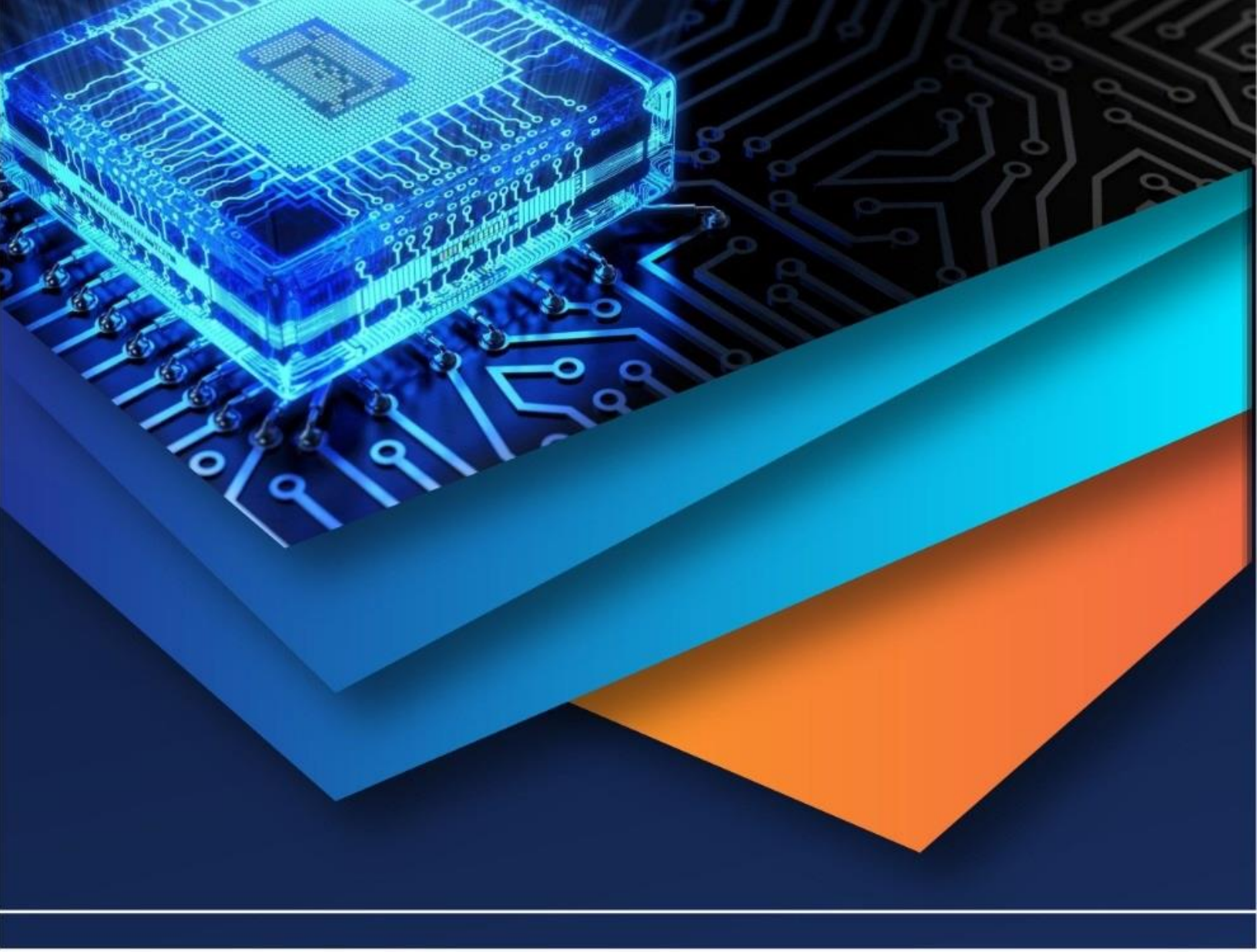






REFERENCES

[1] Das .P, Samantaray. S, and Rout G. R, "Studies on Cd Toxicity in Plants a Review", Env. Pollution vol. 98, pp. 29-36, 1997.
[2] FerhadMuradoglu, MuttalipGundogdu, SezalEricisil,"Cd Foxcity Affects Chlorophyll-a & Chlorophyll-b Content, Anti-oxidant Enzyme Activities and Mineral Nutrient Accumulation in Strawberry – Biological Research", 2005
[3] Gill, Mukti,"Heavy metal stress in plants a review", International Journal of Advance Research, vol. 2, issue – 6, pp. 1043-1055, 2014
[4] Hawkes, J. S.,"Heavy Metals, J. Chem",Edu. 74,pp. 1369-1374, 1997
[5] Hewilt, E.J., "Metal Inter-relationship in Plant Nutrition J", Exp. Bot. 4, pp. 59-64, 1953
[6] 'IR-36 – The world's most popular rice' – International Rice Research Institute.
[7] K. Padmaja, D.D.K Prasad, A.R.K Prasad,"Inhibition of Chlorophyll Synthesis in Phaseolus Vulgaris. L. seeding by Cadmium Acetate", Photosynthetics, vol. 8, 1990
[8] Randloph Barker et. al, The Rice Economy of Asia, pp. 46-53.
[9] Raziuddinet. al, "Effects of Cadmium and Salinity on Growth and Photosynthetic Parameters of Brassica sp., Pak-J BOT", vol. 43 (1), pp. 333-340, 2011.
[10] R. K. Rattan, S. P. Datta, P. K. Chhankar, K. Suriababu. September,"Long term impact of immigration with sewageeffluents on heavy metal content in soils crops & ground water" – a case study – Elsevier pp. 310-323, 2005
[11] Ross S.M,"Toxic Metals in Soil-Plant Systems", Wiley Chichestor, pp. 469, 1994.
[12] Saha . J.K, Panwar NR, Singh M.V., "Determination of Lead & Cadmium concentration limits in agricultural soil and municipal solid waste compost through an approach of zero tolerance to ford contamination. Pub.med.
[13] www.ncbi.nim.nim.gov", 2010.
[14] Stiborova et al."Effect of Heavy Metal Ions in Growth & Bio-chemical characteristics of Photosynthesis of barley and maize seedlings, Biol. Plant" vol. 29, pp. 453-467, 1987
[15] Verklejii, J.A.S, "The effects of heavy metals stress on higher plants and their use as bio-monitor" H, New York, vol. 10, pp. 415, 424, 1993.
[16] www.trendingtopmost.com/aggriculture.
[17] Yanqun. Z, Yuan.L, Jianjun. C, Haiyan. C"Hyper accumulation of Pb, Zn and cd in herbaceous grown on Lead-Zinc mining area in Yunnan Chaina", Env. Int. vol. 31, pp. 755-762, 2005.



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY