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Use of Sawdust- Biochar Amended Wood Pulp as A Substrate for Container Cultivation

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Abstract: Soilless substrates have many advantages over soil based system as they provide optimal conditions for plant growth when compared to soil-based agricultural practices. Different substrates are currently being used as support to the root system of plant. Substrates can be organic such as peat, bark, bagasse, sawdust, rice hulls, wood chips, etc. They can be inorganic mineral based such as sand, gravel, perlite, and stone wool slab. As the second phase of an earlier work by one of the authors on softboard as a novel wood fibre-based substrate for hydroponic systems, the present study was carried out to explore the effects of biochar amendment to wood pulps (or pulp wastes generated from fiberboard factories), on seed germination and seedling growth of Green gram (Phaseolus aureus) crop. The study also included a comparison of seedling growth in hardwood pulp and softwood pulp and to select the most suitable one for container cultivations.
Keywords: Sawdust, biochar, wood pulp, green gram, container cultivation

I. INTRODUCTION

Soilless culture has expanded into different regions enabling farmers to produce high yields and produce high quality crops, even under adverse growing conditions (Gruda,2009). As its name implies, it is an art of cultivation of plants using a substrate that create without soil. So the medium may be a solid or liquid with organic or inorganic substrates (Hussain et al.,2014) To ensure growing medium will always be good for agricultural purpose. Therefore, the medium should provide plants with physical support, regulates the water flow, serves as a reservoir of nutrients and permits gas exchange to and from the roots (Yildiz,2008). As part of the ongoing efforts of The Western India Plywoods Ltd, a large wood-based industrial complex in India, to find out whether the wood pulp wastes generated from its factories could be used for making low cost substrates for container cultivation, the present work was undertaken on wood pulp blended with sawdust-biochar. The study also included a comparison on the effect of different substrates on plant growth (Sreenivasn,2018).

II. MATERIALS AND METHODS

In this work, four combinations of growing substrates were made with different proportions of biochar, sawdust, mechanical hardwood pulp obtained from the Hardboard factory and the imported, unbleached sulphate softwood pulp obtained from the Pre-Compressed Board (PCB) factory of The Western India Plywoods Ltd, Kannur, Kerala. Biochar was produced by heating sawdust in a muffle furnace at 400^0C. Seeds of Green gram (*Phaseolus aureus*) were used for the experiments. The germinated seeds were counted by taken as emergence of 2 mm radicle at the time of observation. Germination percentage (GP) was calculated using the formula: (GP%) = g×100/30; Where 'g' is the number of germinated seeds and 30 is the total number of seeds. After 10 days, the growth parameters were estimated after uprooting and cleaning the seedlings. 10 seedlings were randomly selected from each treatment and their shoot length, root length were measured. Also fresh weight and dry weight were measured with digital weighing balance.

III. RESULTS AND DISCUSSION

The substrates made from wood pulp (both hardwood pulp & unbleached sulphate softwood pulp) blended with sawdust biochar were developed and experiments were conducted to see whether they support the plant growth in their initial stages of establishment.

Substrate	Germination (%)	Shoot length (cm)	Root length (cm)	Fresh weight (g)	Dry weight (g)
Softwood pulp	92.40	22.32	5.20	0.429	0.031
Softwood pulp + Biochar (5%)	82.54	22.70	4.22	0.414	0.033
Hardwood pulp	95.72	17.02	6.30	0.351	0.035
Hardwood pulp + Biochar (5%)	89.90	18.68	7.14	0.417	0.042

Table 1. Effect of substrates on seed germination and seedling growth of Green gram (Phaseolus aureus)

As evident from Table.1 and Fig.1, the results showed a difference in the percentage of seed germination and seedling growth of green gram in different substrates, hardboard pulp and unbleached softwood pulp. Highest percentage and slightly better growth was obtained with hardwood pulp when compared to the other. Addition of biochar at 5% level was found to promote the shoot growth of seedlings in the case of both hardwood pulp and softwood pulp and root length in hardwood pulp only. Similar promoting effects of peat, a carbon rich biomass substance when combined with wood fibres were observed by Dr.Jackson (2018).

Fig.1. Growth stages of Green gram (Phaseolus aureus) seedlings on wood pulp-based substrates

IV. CONCLUSIONS

This study of seed germination and seedling growth of Green gram (*Phaseolus aureus*) on different wood pulp-based substrates revealed their potential for use as components of soilless media for container cultivation. Observations recorded during this investigation also showed the beneficial effect of sawdust biochar amendment with wood pulp on growth and development of plants. Further studies on this line are required before promoting these wood-based materials as promising organic substrates for plant cultivation.

V. ACKOWLEDGMENT

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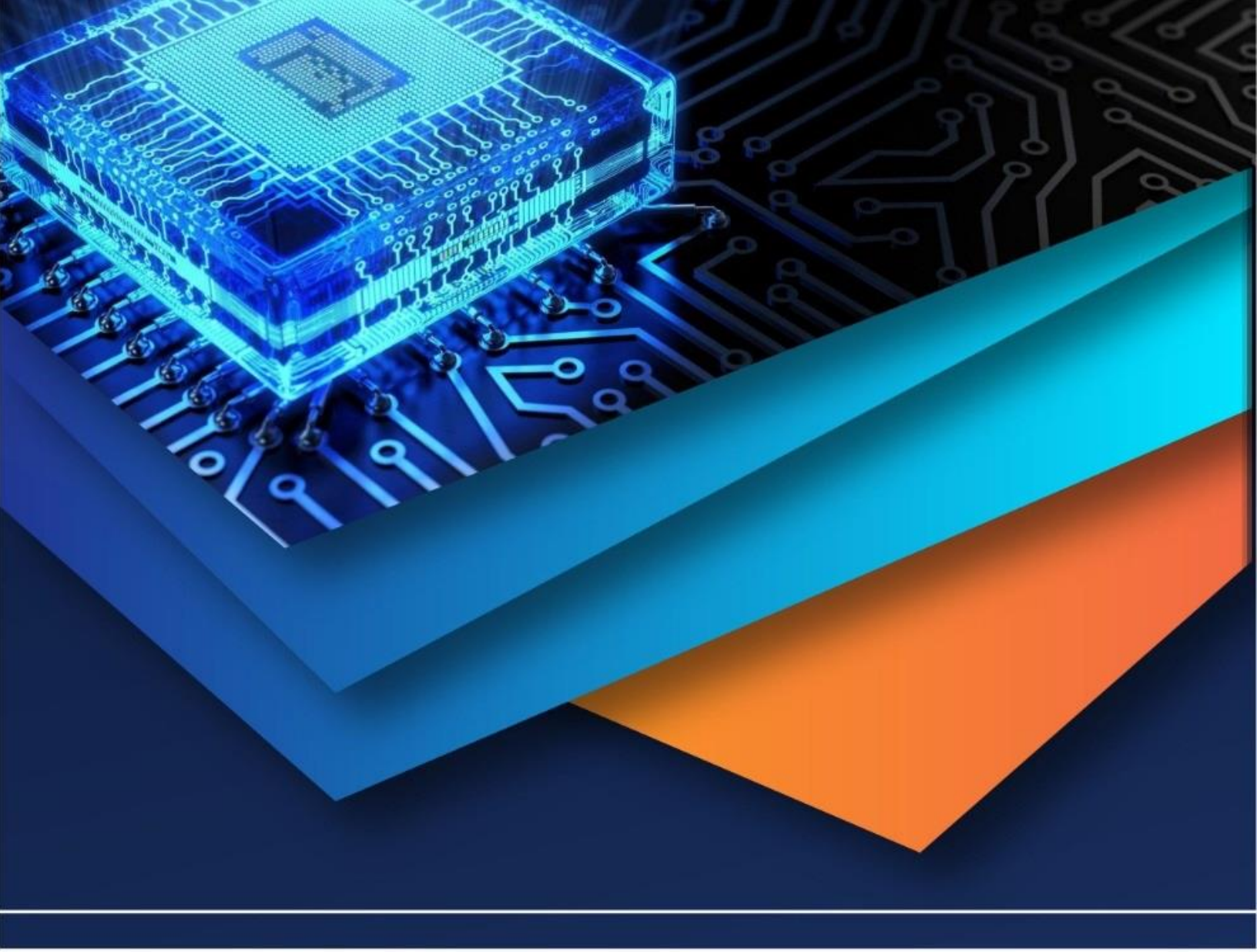
REFERENCES

[1] Jackson BE (2018) Substrates on trial: wood fiber in the spot light. Green house management, Available from: https://www.greenhousemag.com.
[2] Gruda N (2010). Sustainable Peat Alternative growing media, XXVIII International Horticultural Congress on science and Horticulture for people (IHC2010) International symposium on 927,973-979.
[3] Gruda N (2009). Do soilless culture systems have an influence on product quality of vegetables. journal of applied Botany and Food Quality 82, 141- 147.
[4] Sreenivasan E (2018). Softboard as novel wood fibre-based substrate for Hydroponic systems-A Preliminary Study. International Journal of Research and Scientific Innovation (IJRSI). Vol.V, Issue VIII.ISSN 2321–2705.
[5] Yıldız N (2008). Diatomite: A New Substrate for Hydroponics International Meeting on Soil Fertility Land Management and Agroclimatology.Turkey, 527-536
[6] Hussain A, Iqbal K, Aziem S, Mahato P and A.K Negi, (2014). A Review on the Science of Growing Crops Without Soil (Soiless Culture) – A Novel Alternative for Growing Crops. Int. J. Agri and Crop Sci./7-11/833-842



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