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Abstract: The present study titled “Growth and Biomass Production of Energy Plantation Tree Species in Agro-Climatic Zones of Jharkhand” was conducted in three agro climatic sub zones (IV, V and VI) of zone seven in Jharkhand, India. Three energy plantation tree species viz. *Acacia auriculiformis*, *Cassia siamea* and *Eucalyptus hybrid* were studied with the objectives to know the survival and growth performance of these tree species, biomass and carbon sequestration ability of trees, and estimation of calorific value of tree species of energy plantation growing in different agro-climatic sub zones of Jharkhand. On the basis of the availability of energy plantation, three districts each from above sub agro climatic zones of Jharkhand were studied in detail. The important parameter related to the objectives such as tree height, tree diameter, basal area, volume, fresh and dry biomass (above and below ground), carbon sequestration potential, calorific value, major wood nutrients and soil properties of the plantation areas were studied. The results of the study showed higher growth performance in *Eucalyptus hybrid* compared to *Acacia auriculiformis* and *Cassia siamea* in the different zone of Jharkhand State. The biomass and carbon sequestration ability of *Eucalyptus hybrid* was also reported higher compared to *Acacia auriculiformis* and *Cassia siamea*, however the calorific value was recorded to be highest in *Acacia auriculiformis*. The soil organic carbon found maximum in *Acacia auriculiformis* followed by *Cassia siamea* and minimum in *Eucalyptus hybrid*. The cost benefit ratio of *Eucalyptus hybrid* was recorded more compared to *Cassia siamea* and *Acacia auriculiformis*.

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