Biomass production of Azzolla Pinnata R. BR. in contaminated soils of Punjab (India)

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Our modern agriculture is heavily dependent upon chemical fertilizers for increasing crop yield which slowly accumulated in the environment and pose a danger to the activity of many other organisms including man. More so, one of the constraints to high yields is the limited availability and high prices of N & P fertilizers. It has therefore became imperative to seek alternative to the chemical fertilizers through renewable organic sources which will not disturb ecology.

Photosynthetic biofertilizers have drawn considerable attention to maintain the fertility status of soil. The conversion of molecular nitrogen into organic form by cynobacteria is considered today as one of the most direct method of utilization of solar energy and also considered as an extremely low cost biofertilizers. *Azolla – Anabaena* symbiotic system has proved to potential N-source in water logged rice ecosystem which is most effective when ploughed into the soil. The natural floating 'nitrogen factory' consists of two plants-the water fern *Azolla* and blue green alga *Anabaena azollae* living together in symbiotic association.

The use of *Azolla* with its 'nif' genes receives considerable interest as an efficient biofertilizer. The algal symbiont *Anabaena* is harboured in the ventral side of the dorsal leaves of *Azolla* and remained present during all stages of frond development. It is very sensitive to the presence or absence of suitable concentration of nutrients and soil pH. *Azolla* grows well in alkaline soils. Though enormous studies were made on the potential of *Azolla* as a biofertilizers, yet a very little attempt has so far been made on its productivity under contaminated soils.

Keeping in view, these soils as an important environmental stress, the present investigation has been undertaken to utilize these soils as a cheep source for cultivation of *Azolla*. The objective of the present paper is to explore the effect of certain contaminated soils of Punjab on *Azolla* biomass production. *Azolla pinnata* R. Br. was collected from natural pond in Botanical Gardens, Punjabi University, Patiala. *Azolla* plants were grown for 30 days under direct sun light in earthen pots containing 2 Kg of contaminated soils viz. Alcohol distillery soil type AD; Sewage disposal soil type SD; and soap factory soil type SF along with control garden soil after floding the pots with tap water.

The present investigation made it clear that *azolla* can be grown on contaminated soils very well. Data showed a marked increment in biomass production of *Azolla* when cultured under these soils. Fresh mass increased about 89% and 59%; Dry mass 64% and 38% when grown in type AD & SD respectively over control. Higher frequencies of algal heterocysts were observed to be 20% and 28% more than in control. Similarly Relative Growth Rate increased about 51% in type SD soil whereas 54% growth rate increment was noted in type AD soil. The increment in biomass production is positively correlated to the amount of available phosphorous, potassium and organic carbon of these soils. However, type SF soil inhibits the growth of *Azolla*. The unsuitability of fern to grow in this soil may be linked with high soil pH which influences the availability of P & K ions. Higher doses of phosphorous, potassium and organic carbon of the soils increased the chlorophyll and nitrogen content of fern. Chlorophyll content increased 15% & 12% whereas Nitrogen content 43% & 18% over control when grown in type AD & SD soils respectively. The possession of lower chlorophylls coupled with yellowish colouration of fronds in SF soil might be due to comparatively lower dose of P and high pH.

The results conclude certain interesting & suggestive remarks that contamination under certain optimum doses certainly plays a vital role in boosting *Azolla* biotechnology. Alcohol distillery (AD) and sewage disposal (SD) soils could serve an effective growth promoting, easily available and low cost resources for *Azolla* cultivation with remarkable biomass production which if used as a biofertilizer increase the productivity of rice crop and at the same time minimizing the cost of inputs making agricultural technology increasingly profitable.

Key words: *Azolla pinnata*, Contaminated soils, Biomass production, Chlorophyll, Nitrogen Content.