6. SUMMARY AND CONCLUSION

- Essential heavy metals, Cu and Zn induced toxicity to plant depending on the concentration and duration of metal treatment and plant growth stage. Cu was more toxic than Zn to rice.

- Excess Cu induced oxidative stress in rice plant enhancing the ROS production and increasing lipid peroxidation. Root suffered more damage than shoot.

- Stimulation of antioxidant enzymes and antioxidant contents reflected the ability of the rice plant to withstand the Cu induced oxidative stress.

- Proline accumulation also appears to be an additional defense strategy against Cu oxidative stress.

- Zn also induced oxidative stress in plant when excess by increasing ROS production, lipid peroxidation and with differential response in antioxidant defense system.

- Enhancement in the antioxidant enzymes, SOD, GPX and APX activity under Zn stress shows their important role in the adaptation process. Increased in proline content implied its protective role in rice plant against Zn stress.
Zn alleviated Cu toxicity by restricting Cu uptake and stimulating the antioxidant enzyme activity and Zn could be used to ameliorate Cu toxicity.

On the basis of the present finding it can be concluded that the tolerance of MSE-9 to Cu stress is mainly due to the positive response of antioxidant enzymes. The insufficient response of antioxidant enzymes in Pankaj makes it susceptible to the stress and can be regarded as a sensitive variety to Cu stress. Tolerant or sensitive to Cu stress chiefly depended on the response of antioxidants revealing the importance of antioxidant enzymes against stress. Uptake restriction also provided a mechanism to withstand against Cu stress.