



Effects of exogenous melatonin on Cd/As stress in rice

Dr. Qiongli Bao

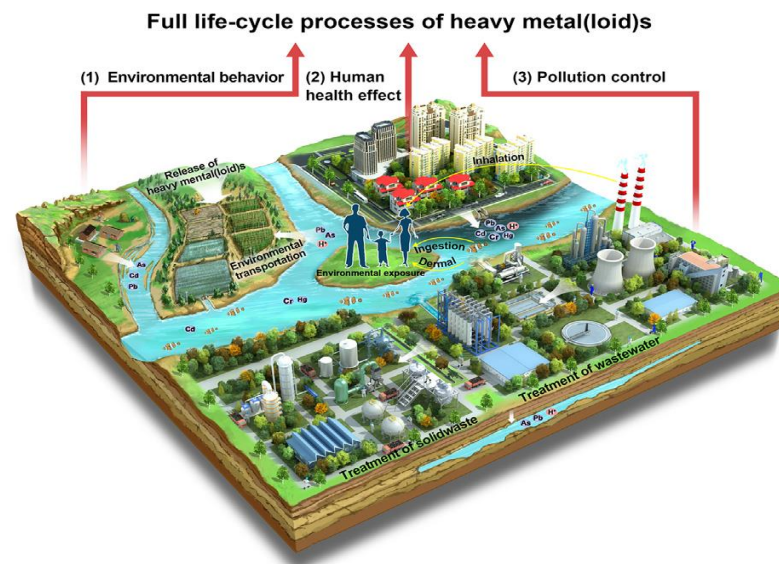
Agro-Environmental Protection Institute,
Ministry of Agriculture and Rural Affairs,
China



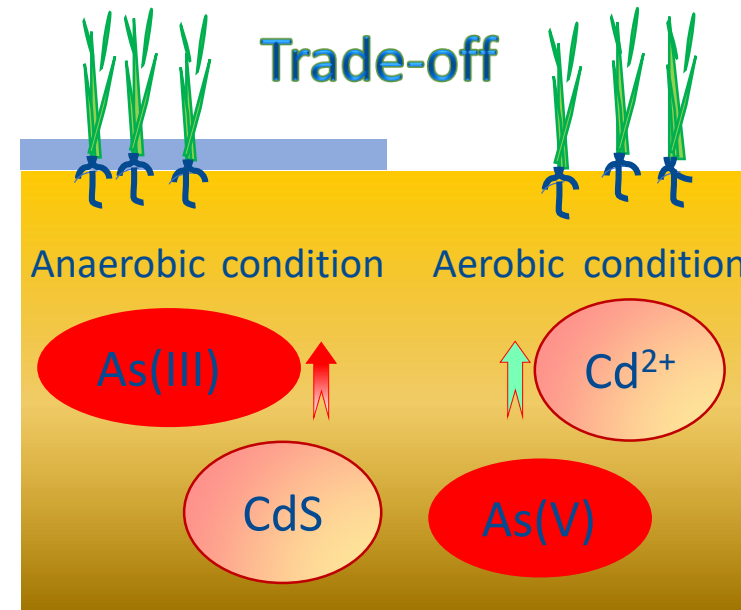


Cd/As pollution status

- The excess rate of soil Cd points reached 7.0% in China
- As the third major pollutant in soil, arsenic has been a difficult problem to control
- The trade-off relationship exists between As and Cd availability under water condition

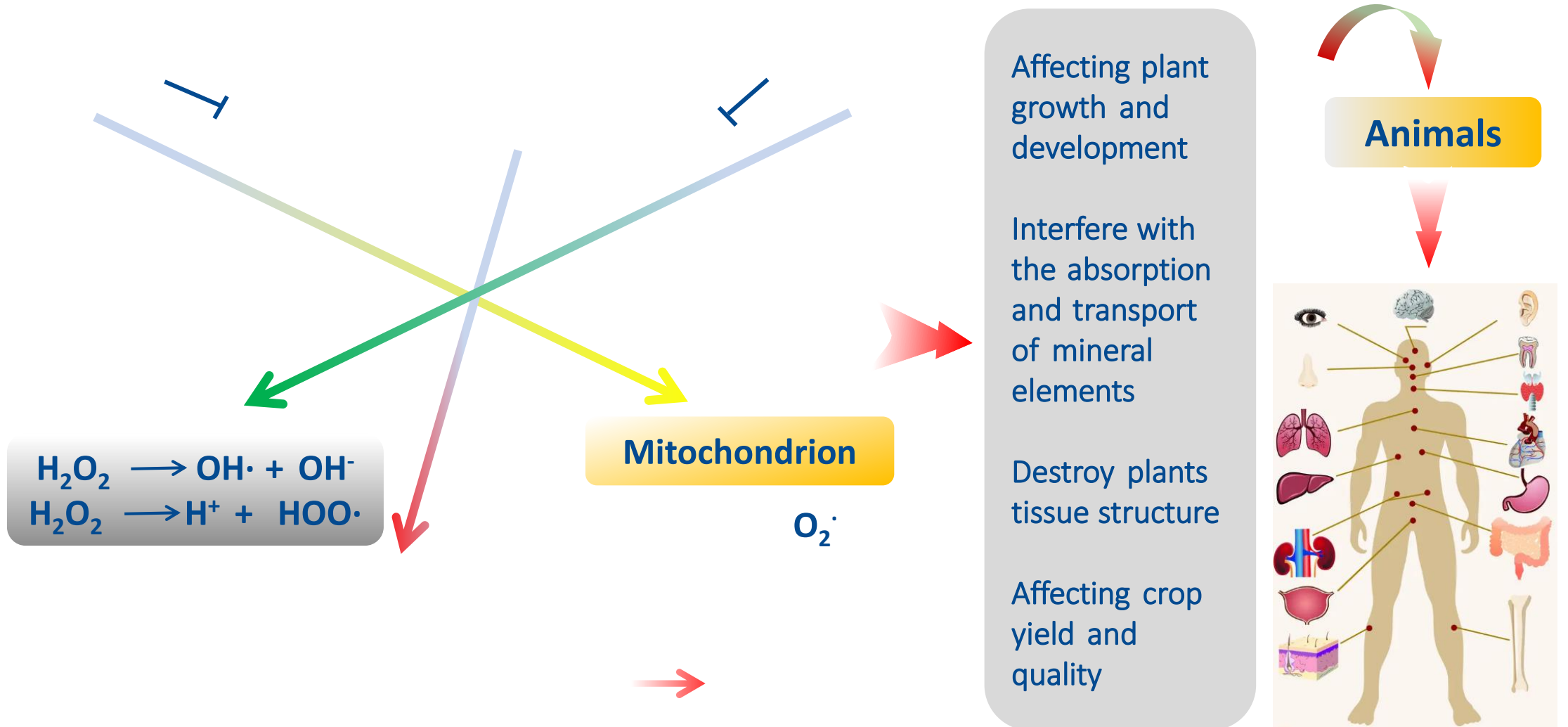


(Deng et al., 2022, Eco-Environment & Health 1)



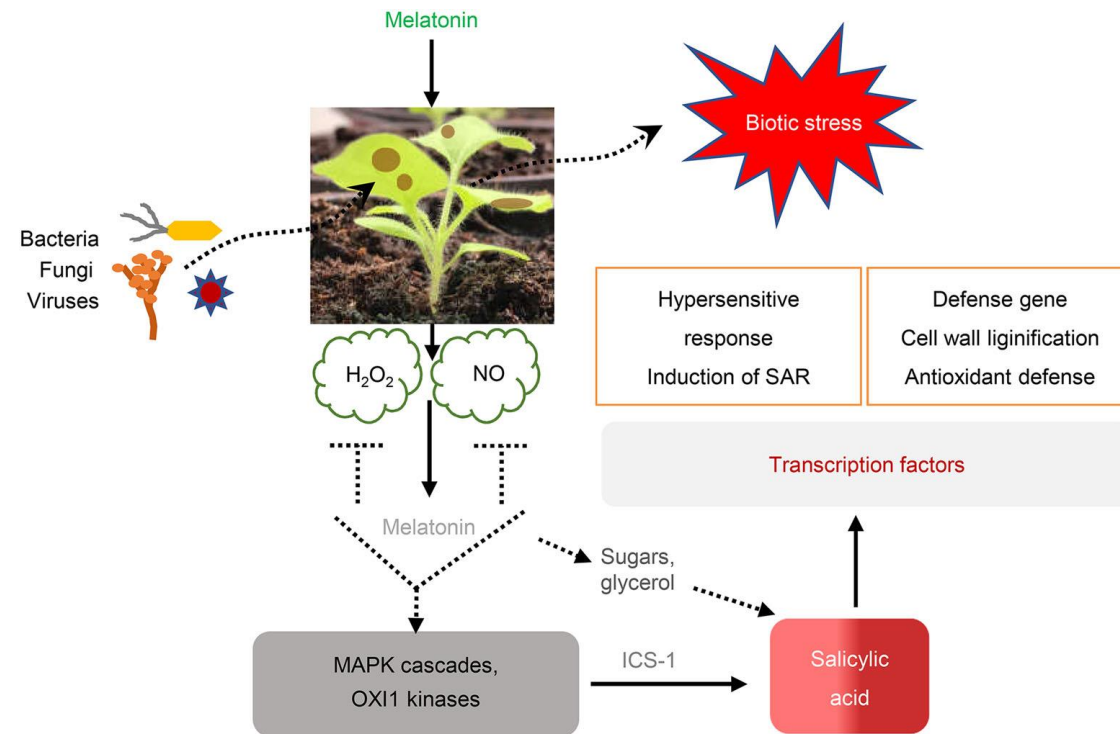
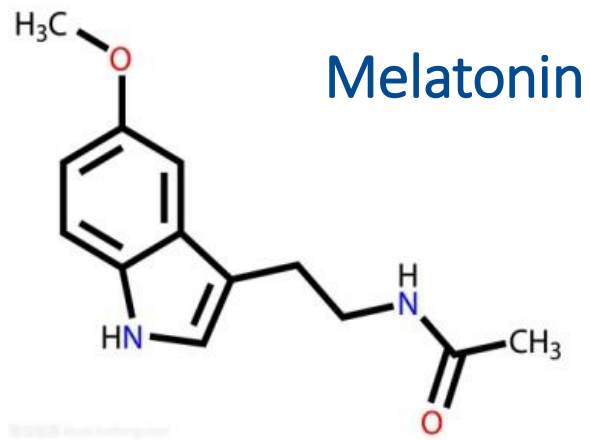
(Deng et al., 2022, EEH)

Soil Cd/As pollution hazards



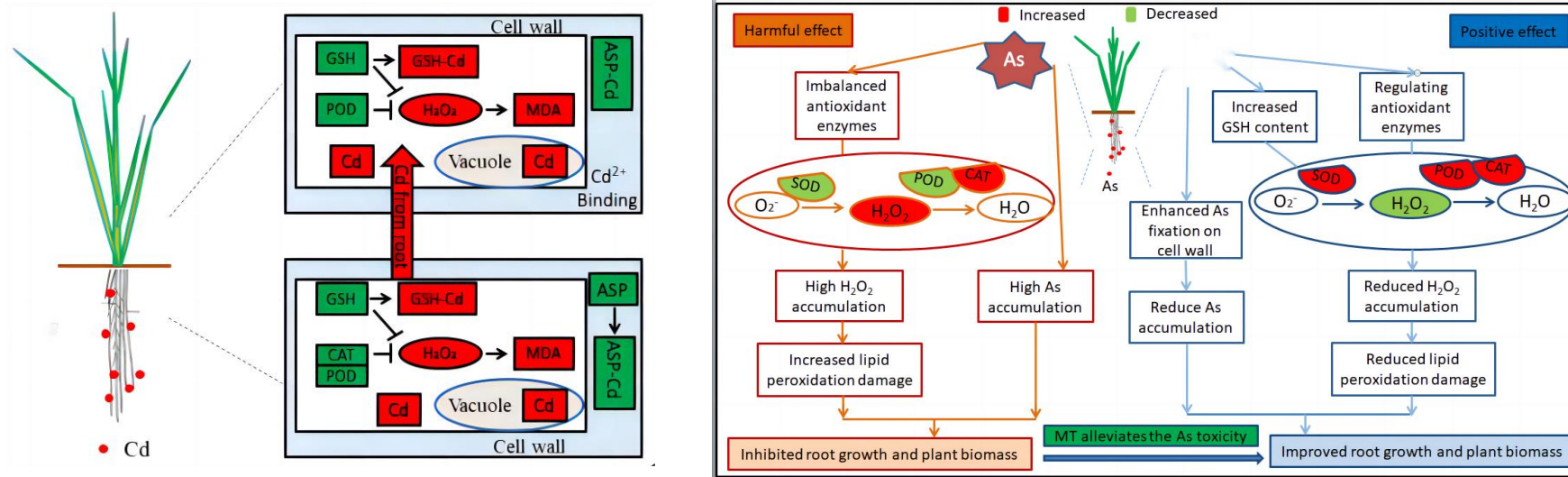


Melatonin (MT)



- MT presents in all plant tissues
- MT is an important antioxidant involved in many cellular activities
- MT significantly improves plant tolerance to the environment stress
- MT shows great function in inducing heavy metals tolerance

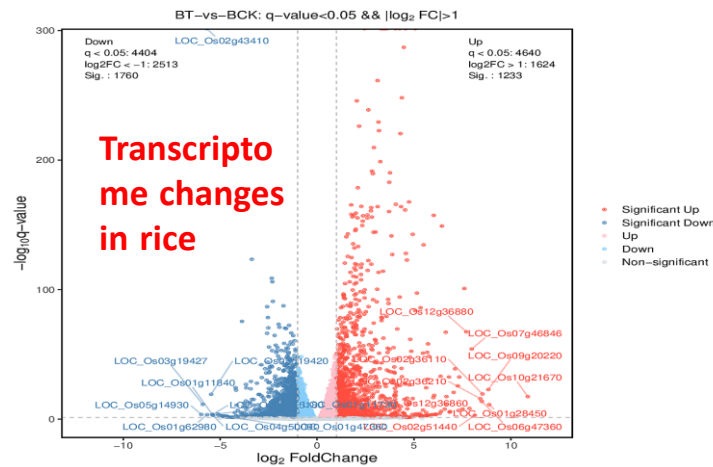
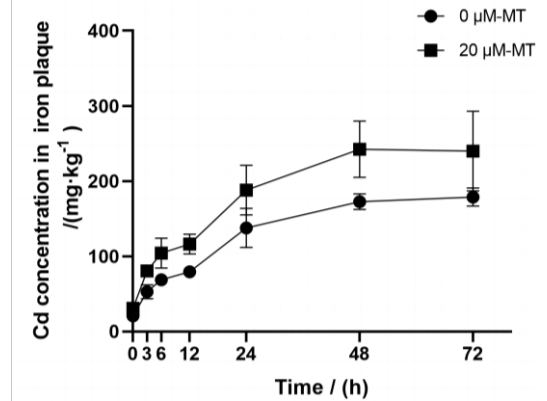
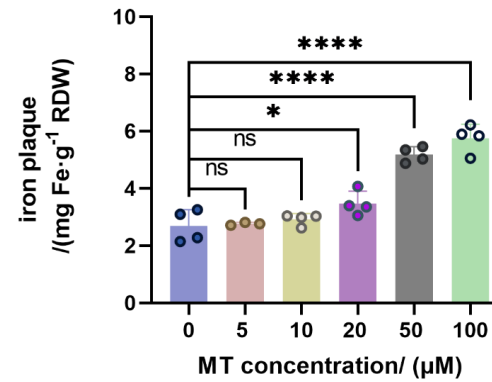
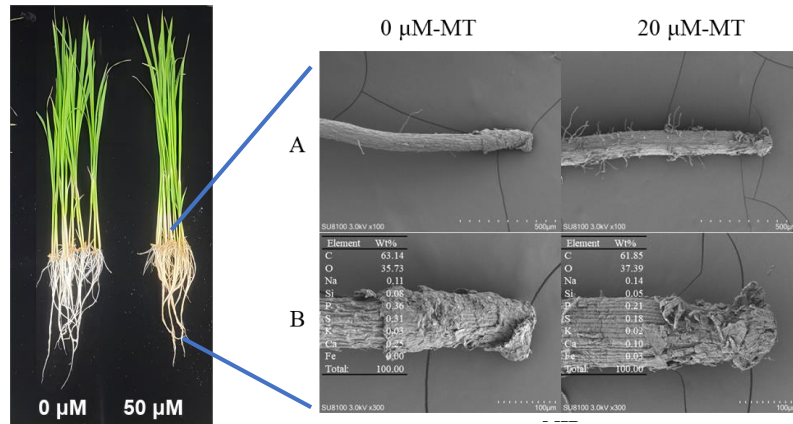
MT regulates physiological and transcriptional changes of rice under Cd/As stress



- MT significantly reduced the absorption, transport, and accumulation of Cd/As in rice
- MT increased pectin and Cd/As contents in pectin in root cell wall, increased the adsorption sites of Cd/As, and improved the retention of Cd/As by cell wall, thereby reduced the migration of Cd/As into protoplast
- MT increased SOD, POD, and CAT activities, GSH content, inhibited H₂O₂ and MDA production, thus enhanced the antioxidant defense ability of rice

Li et al., 2022, Environ Pollut; Li et al., 2022, Chemosphere

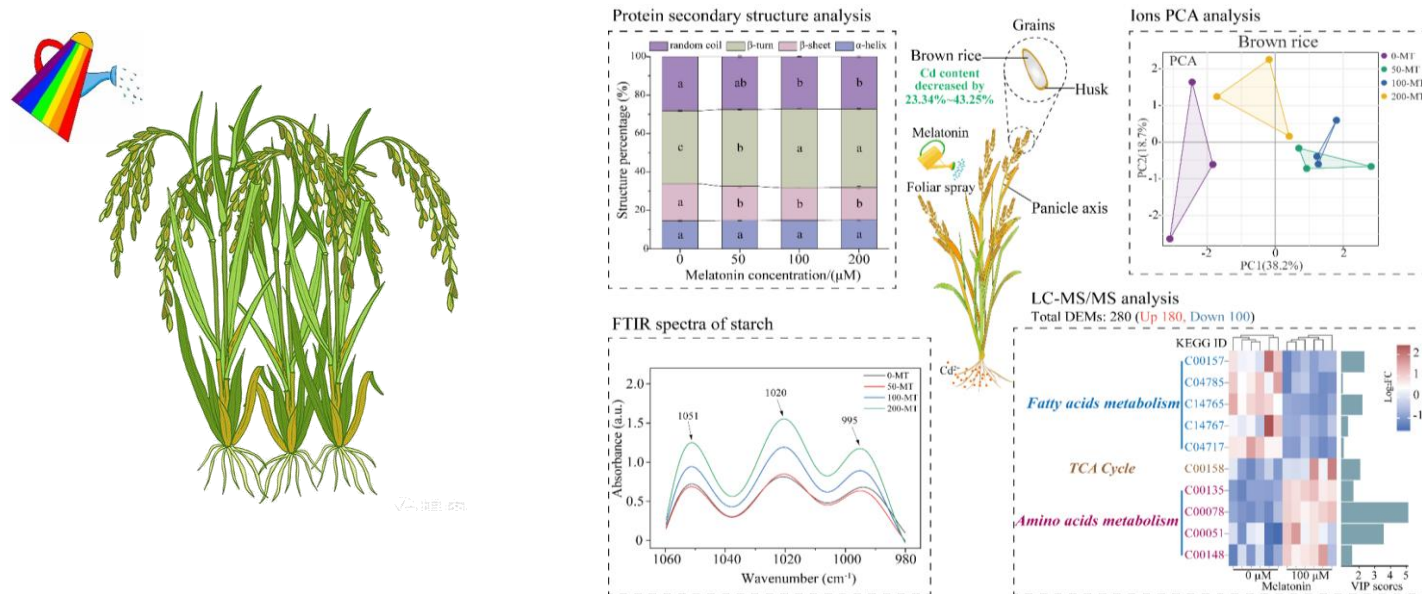
MT regulates physiological and transcriptional changes of rice under Cd/As stress



- MT induced the formation of iron film in rice roots, played an important role in blocking Cd
- MT significantly down-regulated the expressions of Fe transport-related genes *OsTOM1*, *OsENA1*, *OsYSL15*, as well as the Cd transport-related genes *OsIRT1*, *OsNRAMP1*, thereby promoted the formation of iron plaque and the retention to Cd

Liu et al., 2024, unpublished data

The metabolomics mechanism of MT on «Cd reduction and quality improvement» of rice



- MT changed the protein secondary structure and the short-range order structure of starch, thus improved the eating quality of rice
- MT significantly decreased fatty acid metabolites, while increased amino acid metabolites, citric acid, and melatonin bioanabolism, indicating that MT reduce rice Cd through regulating metabolic network of rice

Liu et al., 2024, Food Chemistry



Qiongli Bao

15900343312@163.com

Agro-Environmental Protection Institute,
Ministry of Agriculture and Rural Affairs