CHAPTER 7

RECOMMENDATIONS

1. The effects of soil lead in abandoned mining areas, roadside farms, and agricultural fields with untreated industrial effluent and sludge as a fertilizer and irrigated water containing heavy metals, should be continuously monitored by using phytotoxicity tests. Besides the effects of heavy metals, the phytotoxic effects of pesticides and herbicides should be studied.
2. Herbaceous annual plants, including both agricultural and native species, should be selected for phytoxicity tests rather than tree species to obtain rapid and reliable results. If trees are tested, vegetative propagated parts or at least one year old seedlings should be used. In order to discover hyperaccumulators, more native herbaceous plant species should be studied.
3. Phytotoxicity tests should be done under controlled nursery conditions especially light and temperature because plants can not be grown uniformly before treatments at a normal nursery. Before treatment, plants within a species should have uniform size and age in phytotoxicity tests.
4. In phytoxicity tests, essential nutrients (N, P, and K) for plant growth need to be supplied to ensure that plant growth is not limited by their deficiencies. Fertilizer application affects metal uptake by plants. So, nutrient compounds or solution used in phytoxicity tests should be free from chemicals which can react with test metal and heavy metals. The amounts of fertilizer should be considered.
5. Lead concentrations tested should be more than EC_{50} concentration. For seed germination tests, lead concentrations tested in my study are suitable. EC_{50} values of most seedlings growth tests parameters were more than 500 μg/g, high lead concentration in my research. A higher lead concentration for the seedling growth test should be used (> 500 μg/g).
6. Exposure duration for herbaceous plants in my research is enough for observing the effects of lead. Trees (*Shorea roxburghii*) need more exposure time.

7. Since roots are the most sensitive and affected tissue for lead pollution in soil, some methods that may increase the tolerance of plants should be tested *e.g.* mycorrhiza application. Hagemeyer (1999) suggested that mycorrhiza can help higher plants survive in contaminated habitats because of their fungal sheath, which can act as a barrier to toxic metals. Mycorrhiza inoculation should be tested in the seedlings treated with heavy metals.
8. Since solid growth mediums (soil or sand) allow the establishment of mycorrhiza, such medias should be sterilized for phytotoxicity tests.
9. Most contaminated sites are polluted by more than one heavy metal. The effects of this mixture on plants should be tested. Combinations of essential metals and nonessential metals *e.g.* cadmium and copper for plant growth should be tested.
10. Since lead effects early seedling growth, the effects on flowering, fruit, *etc.* should also be studied to reduce the potential accumulation toxic effects on human health especially in fruit trees grown in contaminated sites.
11. As FA is a potential sensitive index for biomonitoring, more studies need to refine and determine this method. FA symptoms in others plant species should be studied.
12. Since cost estimates of herbaceous plant in phytoremediation system is US $ 3000 for one acre, this cost is relatively cheaper than other remediation technologies. The cost estimation is shown in Table 50.

Table 50. Cost estimates of herbaceous plant in phytoremediation program (one acre)

Activities	Estimates cost (US $)
1. Preparation: soil testing, site visit, transportation, and design	1000
2. Installation of plants (10,000 plants/acre): soil preparation, seed collection, pre-planting irrigation, and fertilizer application	500
3. Maintenance costs: weeding and irrigation	200
4. Harvesting costs	300
5. Clean up of concentrated pollutants in plant tissues	1000
Total cost	**3000**