

Micro-nutrients

Eight of the 16 essential plant nutrients are known as **micro-nutrients**, and are sometimes called trace elements or minor elements. They include boron (B), cobalt (Co), copper (Cu), chlorine (Cl), iron (Fe), manganese (Mn), molybdenum (Mo) and zinc (Zn). Their availability in soils is affected to a large degree by soil pH, as illustrated in **Figure 7.1**.

Although micro-nutrients are required in only small amounts, they are just as important in plant nutrition as the major and secondary nutrients. An insufficient amount of any trace element in the soil can limit plant growth, even when all other essential nutrients are present in adequate amounts, in accordance with von Liebig's Law of the Minimum mentioned in **Chapter 1**. In nearly all cases, Australian soils are adequately supplied with cobalt and chlorine, their deficiencies are rarely observed and they are of little practical concern.

The fact that micro-nutrients are required for healthy plant growth has been known for many years, and

their use as fertilizer has been widespread since their discovery. Why have micro-nutrients become so important in recent years? Several reasons stand out:

- **Increasing crop yields:** Higher crop yields remove large amounts of the micro-nutrients and place greater strain on the ability of the soil to supply them for plant growth. Micro-nutrients are not added as often as the major nutrients, nitrogen (N), phosphorus (P) and potassium (K), or secondary nutrients. Thus, as larger amounts of micro-nutrients are removed from the soil in crop and animal products, larger amounts of them are required. Some soils are unable to meet the demands of today's high-yielding crops and some soils are very poorly supplied with them in their natural state.
- **Past fertilizer practices:** When yields were lower, one of the three major nutrients was usually the limiting growth factor. For example, the application of nitrogen fertilizer led to a micro-nutrient deficiency.
- **Changing soil pH:** In some soils, the use of lime has raised soil pH and reduced the availability of nutrients such as zinc and manganese, while in others, soil acidification and lowered soil pH have reduced the availability of molybdenum, often resulting in a deficiency of this important element.
- **Fertilizer technology:** Fertilizer products often contained small but significant amounts of some of the micro-nutrients as impurities, masking marginal deficiencies of micro-nutrients in soils where these fertilizers were applied. Modern, high-analysis fertilizers and changes in the source of raw materials used in fertilizer production mean that today's fertilizer products often contain lower levels of the micro-nutrients as many of these

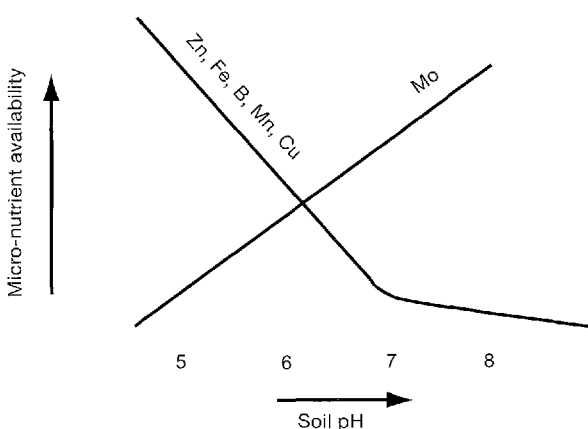


Figure 7.1 Relative availability of micro-nutrients as affected by soil pH.