Department of Agriculture
Western Australia

Optimum soil pH for crop plants

Farmnote 47/2002

Soil acidity series

Patricia Hill, Development Officer, Ravensthorpe Community Agricultural Centre

Every crop has an optimum soil pH range. Within this range (seen as the bright green sections of the tables below), production potential is maximised. The plant's critical range is the range of soil pH in which the crop will obtain 80% of maximum yield potential, and is the pale green section of the tables below. If a crop is grown in a soil where the pH is either too low (too acidic) or too high (too alkaline), then productivity will decline to below 80% of maximum yield potential.

Crops that have an optimum pH range that is less than 4.5 are described as acid tolerant (this includes rye, oats and lupins), while plants that have an optimum pH range above 6 are acid sensitive. Although the tables give a general idea of the optimum soil pH range for a variety of crop plants, it is important to realise that other factors can affect the actual optimum soil pH for a crop. These include:

1. **Variety:** for example, the wheat variety Westonia is tolerant of, whereas the variety Cascades is sensitive to, low soil pH. Another example is Wodjil (yellow) lupins, which are extremely tolerant of low pH soils compared with other varieties.

2. **Environment:** soils that are very acidic can cause root stunting, resulting in reduced uptake of water. Subsequently, crops grown in soils that are too acidic are more prone to drought stress than unaffected crops. High rainfall environments will therefore alleviate some of the problems associated with acidic soils.

3. **Soil nutrient status:** stunted roots are also unable to take up sufficient nutrients. Plants grown in soils that are too acidic will have better productivity if nutrient levels are very high. This compensates for reduced uptake.

4. **Rhizobium tolerance:** the acidity tolerance of nodule-forming bacteria can sometimes be less than that of the host plant. This means that although the plant may be able to grow quite well, its ability to form nodules will be impaired. Consequently, nitrogen may need to be applied to legumes in very acidic soils in order to maximise productivity.

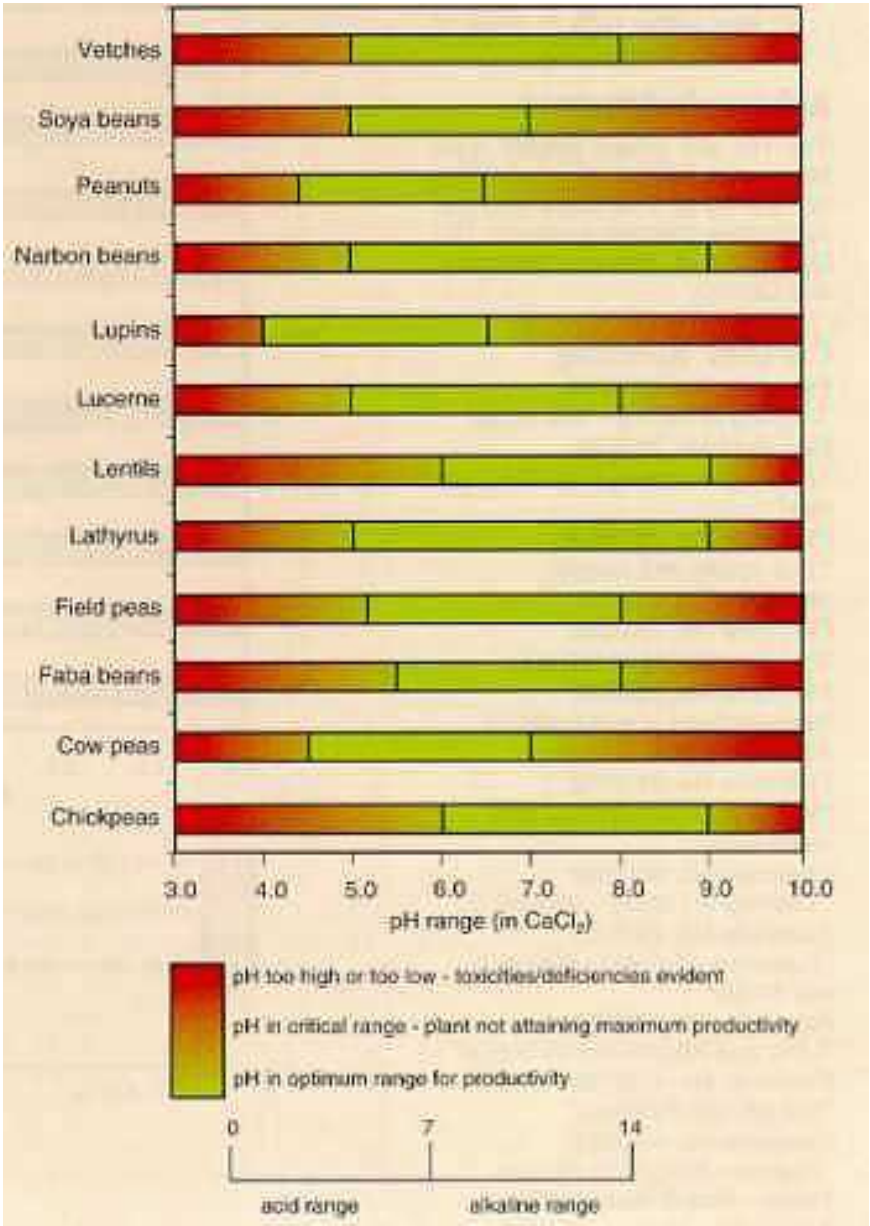

Table 1. Optimum pH range for common agricultural crops : legumes

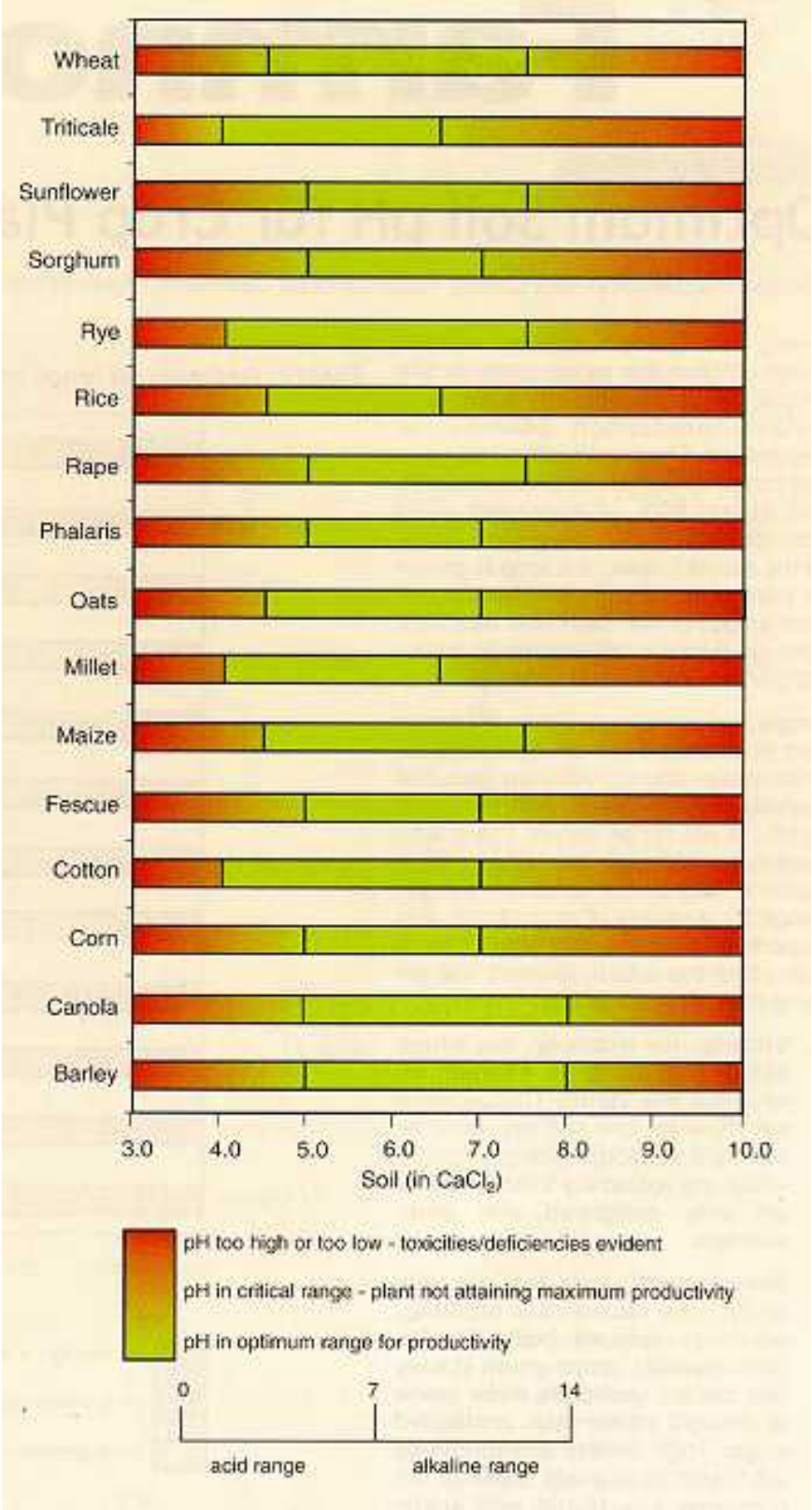

Table 2. Optimum pH range for common agricultural crops : non-legumes

Acknowledgments

The WA soil acidity project is an integrated project of work being completed by The Department of Agriculture Western Australia, The University of Western Australia, and CSIRO.

Further Reading

- Farmnote No. 68/2000 'Looking at Liming - test strips'
- Farmnote No. 70/2000 'Looking at Liming - consider the rate'
- Farmnote No. 79/2000 'Soil acidity and barley production'
- Farmnote No. 78/2000 'The importance of soil pH'
- Farmnote No. 80/2000 'Management of soil acidity in agricultural land'
- Farmnote No. 01/2002 'Methods of lime storage and stabilisation'
- Farmnote No. 38/2002 'Looking at Liming - quality'
- Farmnote No. 44/2002 'Tolerance of wheat varieties to soil acidity'
- Farmnote No. 45/2002 'Lime and Narrow-leafed Lupins'
- Farmnote No. 46/2002 'Soil pH and Pastures'
- Bulletin No. 4343 'Soil Guide - A Handbook for Understanding and Managing Agricultural Soils'.