to domestication associated with development of lupin as a crop plant. The chapter moves from a historical discussion to what they term the "era of modern lupin breeding" and acknowledge the importance of wild lupins as well as natural and induced mutants in modern lupin breeding. A major barrier to development of lupin in many regions with cooler climates was the lack of germplasm with restricted branching or determinacy. They document the development of determinate lines in *L. albus* and its importance during the 1980s to the present. This is an important discussion because indeterminate development and thermosensitivity has been, until recently, one of the most limiting factors to lupin development. Another important topic is the issue of alkaloid content in the seed and in the plant. Sweet types are important for use as human or animal feeds. High alkaloid types are of great interest for pharmacological uses. These authors note that sweet types and high-alkaloid types have two independent uses, and that this has led to a problem for breeding, agronomy, and utilization because sweet types can cross with high alkaloid types and revert to high alkaloid wild types. The industry producing sweet types is obviously very interested in keeping their germplasm sweet.

The next several chapters make up the physiological discussion of lupin in this text, beginning with lupin nutrition by Longnecker, Brennan, and Robson. This discussion deals with a traditional agronomic approach to lupin growth, dealing with the anatomy of roots, the importance of root hairs, lateral roots and depth of rooting, and documents the phenomenon of cluster or proteoid roots. Proteoid roots have attracted many research studies because of their importance in phosphorous nutrition. The chapter outlines the importance of various minerals on lupin growth and development and seed quality.

A chapter is devoted to nodulation, nitrogen fixation, and nitrogen balance of lupin and discusses the unique symbiosis of *Lupinus-Bradyrhizobium* sp. (*Lupinus*). The information documents the conditions that set this symbiosis apart from other legume-rhizobium symbioses, considering edaphic stresses such as soil acidity. The chapter provides mechanistic detail about key events in the symbiosis. The information detailed provides the student or researcher an excellent overview of lupin nitrogen nutrition and symbiosis.

In the chapter, *Transport Physiology and Partitioning*, Pate et al. take a mechanistic approach in looking at source-sink relations of C and N and include sections on growth regulators and transport. The review approaches transport phenomena as a larger issue than lupin. (*Lupin* happens to be an ideal model system for transport study.)

Miles Dracup et al., discuss lupin responses to abiotic stresses such as drought, and include topics of tissue water relations, water deficits, leaf gas exchange rates, and the impact of water deficits on dry matter partitioning and yield. Among the stresses they discuss include temperature, soil alkalinity, mineral deficiencies and toxicities, salinity, soil acidity, waterlogging, and compaction.

The next several chapters in the book are devoted toward discussions of diseases and pests and agronomy and farming systems. In the chapter on diseases and pests by M.W. Sweet-ingham et al., all the major diseases of lupin are discussed which include leaf spots, obligate parasites, vascular wilts, stem and pod blights, root diseases, and viral diseases. The other major limiting factor hindering lupin domestication is disease, in particular susceptibility to anthracnose (*Colletotrichum gloeosporioides* (Penz.) Penz. & Sacc. in Penz.)

In the chapter focused on agronomy and farming systems development, morphology of the plant, interactions with the environment and phenology and plant improvement are related to productivity. The rest of the chapter is devoted to a more conventional discussion of the agronomy of lupin and its role as a rotational crop.

Finally, the last several chapters deal with the utilization and implementation of lupin, an assessment of their value in a farming system, and their food uses. D.S. Peterson provides a history of the composition and food uses of lupins and discusses the historical use of lupin in the Mediterranean and Andean regions and provides a discussion of the fatty acid, carbohydrate and mineral content, and anti-nutritional factors associated with lupin. This is a very detailed chapter, which includes sections on major components of the seed and relates it to their attributes for human consumption.

The use of lupin seeds for ruminant and non-ruminant livestock and fish is detailed. A major topic related to lupin utilization is that of the presence of toxins and the occurrence of lupinosis. Jeremy Allen provides a very detailed discussion of lupin toxins and the occurrence of lupinosis, a mycotoxicosis "caused by the ingestion of toxins known as phomopsins produced by the fungus *Diaportha toxicas*”.

The final chapter focuses on marketing and trade. To date, the success of lupin is primarily an Australian story. This chapter provides an overview of the success of the development of the Australian sweet lupin industry as well as the development of the global market for lupin.

This book is highly recommended for any professional or graduate student interested in lupin. The editors have compiled and synthesized the current state of knowledge on the genus *Lupinus*. The book serves as probably the only comprehensive reference on this genus. Its outlook is international and documents the domestication of *Lupinus* species and provides information regarding agronomy, physiology and other factors affecting production based upon the Australian experience of developing, producing, and marketing this crop to the point of having economic significance. This book serves as a case study for students interested in crop domestication and development. J.S. Pate acknowledged in his chapter that there is an "embarrassingly large proportion of parochially oriented references, which may be viewed as idiosyncratic of Western Australian conditions." Many of the authors are indeed Australian, but when looking at the domestication of this crop and the development of a lupin industry, the real success story has been the Australian story.

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Knowledge of how soils cycle carbon, nitrogen, and other elements at local, regional, and global scales has increased significantly over the past 20 years. Concurrently, there has been growing recognition that, in order to ensure the existence of sustainable environments, soils must be able to perform a variety of functions, such as cycling, storage and release of water and nutrients, energy partitioning, and buffering. Soils in managed ecosystems exhibit cycling features that contrast significantly with those in unmanaged ecosystems in terms of additions, removals, and transformations. The refinement or development of management practices that harmonize production goals with soil functions requires a solid understanding of elemental cycling in soils. In this context, *Cycles of Soil* by