Agry 515, 2008

- Nutrient Stress and adaptation

Table 1. Within natural vegetation, generally two types of species (Table 16.1 in Marschner, 1995)

Table 16.1
Characteristics of Strategies of Wild Plants in Adaptation to Soils with Low or High Nutrient Availability[a]

Nutrient availability	Type I (slow growers)	Type II (ruderal species)
Low (nutrient poor sites)	Low nutrient uptake rates Low growth rates of roots and shoots High root/shoot ratio High leaf longevity High nutrient concentrations in the tissue	Low growth rates Low nutrient storage High root/shoot ratio
High (nutrient rich sites)	Small growth response of roots and shoots High nutrient storage (luxury consumption) Low nutrient use efficiency	High nutrient uptake rate High growth rate High nutrient use efficiency Decrease in root/shoot ratio

[a]Based on Chapin (1980, 1988).

Fig. 1. Type 1 and 2 pursue different adaptive strategies (Fig. 2 in Chapin, 1980)

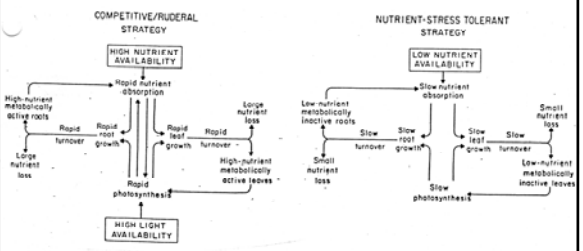

Figure 2 Interacting characteristics of plant strategies that are adaptive under conditions of high or low nutrient availability.

Fig. 2. Type 2s are better for agricultural objectives (Fig. 1 in Bieleski and Lauchli, 1983)

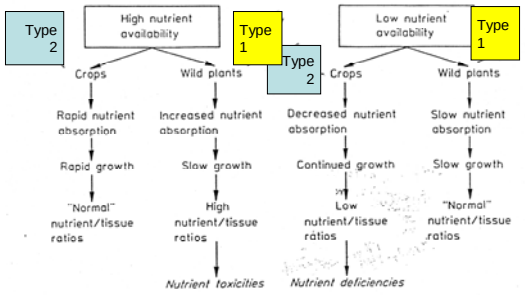

Fig. 1. Responses in mineral nutrition and growth of crops adapted to highly fertile soils and of wild plants that are nutrient-stress-tolerant, in soils of high and low nutrient availability. (Partly based on CHAPIN 1980)

Fig. 3. Adaptation and NUE under can vary markedly among species (Fig 16.1 in Marschner)

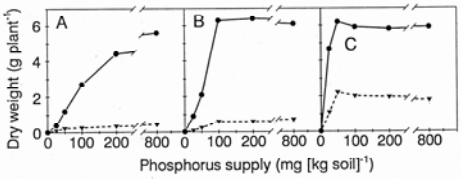

Fig. 16.1 Growth response of three pasture species to phosphorus fertilizer applied to a phosphorus-deficient soil. (A) *Trifolium cherleri*; (B) *Trifolium subterraneum*; (C) *Lolium rigidum* (●, total plants; ▼, roots). (Based on Ozanne *et al.*, 1969.)

Fig. 4. Uptake/root efficiency (UE/RE) dominates w/ low nutrient supply (Fig. 16.2 in Marschner)

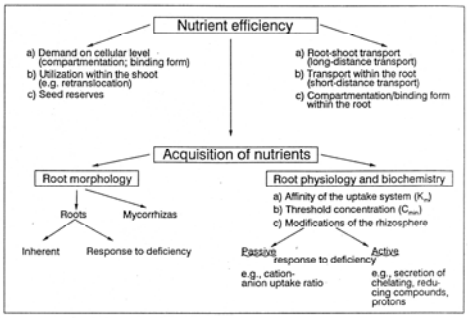

Fig. 16.2 Possible mechanisms of genotypical differences in nutrient efficiency.

Fig. 5. Relative importance of tolerance / exclusion species dependant (Fig. 9.13 in Marschner)

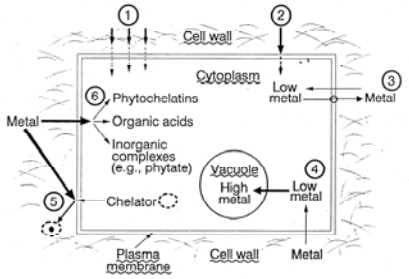

Fig. 9.13 Possible mechanisms of heavy metal tolerance of plants. (Modified from Tomsett and Thurman, 1988.) (1) Binding to cell wall. (2) Restricted influx through plasma membrane. (3) Active efflux. (4) Compartmentation in vacuole. (5) Chelation at the cell wall–plasma membrane interface. (6) Chelation in the cytoplasm.

Fig. 6. Plant productivity inhibited by Al on 40% of arable soils (Fig. 16.6 in Marschner)

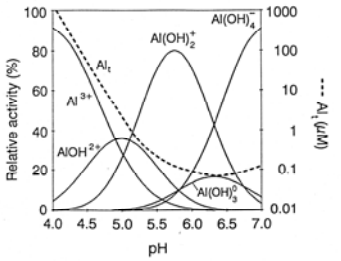

Fig. 16.6 Relative activities of mononuclear aluminum species and total concentration (Al_t) of soluble aluminum as a function of pH. (Kinraide, 1991.) Reprinted by permission of Kluwer Academic Publishers.

Fig. 7. Plants avoid or tolerate root zone Al and Mn (Fig. 16.9 in Marschner)

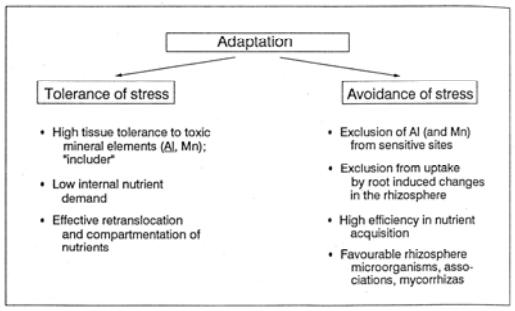

Fig. 16.9 Strategies of plant adaptation to acid mineral soils.