

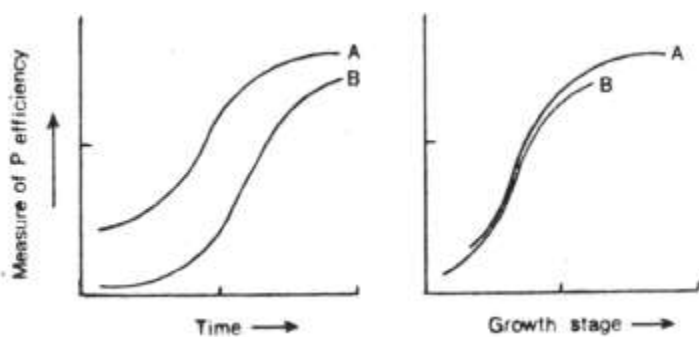
## Evaluation of phosphorus-efficient pasture species

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When evaluating the efficiency with which pasture species and cultivars acquire and use phosphorus (P) it is essential to take into account the usually dissimilar rates of ontogenetic development of the species and cultivars involved. Yet, attempts to relate measures of the P efficiency of pasture species to their ontogeny are rare. This failure to account for the ontogenetic condition, or growth stage, of the species being compared can result in species being ranked in order of P efficiency when the differences between them are more accurately ascribed to dissimilarities in their ontogeny rather than to inherent differences in their morphology, physiology or P metabolism. In other words, there is a need to distinguish between those species that use P fertilizer more efficiently due to superior mechanisms for acquiring or utilising P and those species that, because of greater seedling vigour or a shorter time to maturity, are at a more advanced ontogenetic stage, at a given time, than other species and, for that reason alone, appear more P-efficient.

The major difficulty in comparing species on both an ontogenetic and temporal basis is selecting, or developing, a measure of ontogeny that describes all stages in a plant's development and is a continuous variable. One such measure of ontogeny is Zadoks' decimal code for plant growth stages (1). Measures based solely on vegetative development or plant weight do not allow for the influence that becoming reproductive has on the P nutrition of plants.



**Figure 1. Illustration of two species that differ in their P efficiencies on a temporal basis but not on a Zadoks' growth stage, or ontogenetic, basis.**

Figure 1 shows that, at any given time, Species A is more P-efficient than Species B but the P efficiency of the two species is similar when they are at the same Zadoks' growth stage. Recent experiments comparing the P efficiency of *Lolium multiflorum* and *Phalaris aquatica* have produced results similar to those illustrated in Figure 1 for measures of P efficiency such as P uptake, P content and plant yield.

1. Zadoks, J.C., Chang, T.T. and Konzak, C.F. 1974. *Weed Research* 14: 415-421.