

Diverse Pastures of Complementary Species (DPCS) to buffer dry summer conditions: A Review

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Climate change, through altered rainfall and temperature patterns, affects global pastoral agricultural systems by exacerbating environmental stresses such as extreme temperatures and rainfall deficit or surplus, thereby constraining agricultural productivity and farm profitability. Pastures are increasingly exposed to extreme climate events, highlighting the need for adaptive strategies in pastoral systems to cope with evolving environmental challenges. In temperate humid climates, traditional pastures combining white clover (*Trifolium repens*, Tr) and perennial ryegrass (*Lolium perenne*, Lp), both shallow-rooted species, are losing persistence under these varying climatic conditions. This paper reviews the Diverse Pastures of Complementary Species (DPCS), which are climate-smart pastures that aid to cope and deal with growing water restriction periods in pastoral systems. According to recent studies, DPCS comprising these traditional shallow-rooted species, with the deep-rooted species — pasture brome (*Bromus valdivianus*, Bv) and cocksfoot (*Dactylis glomerata*, Dg) — express enhanced resource utilization, growth asynchrony and overyielding. Particularly in dry periods, DPCS exhibit significant production properties as the combination of hydraulic lift and pasture growth through the soil water restriction period. By managing species functional diversity, DPCS optimize soil water utilization, stabilize forage production, and increase pasture tolerance to climate change effects. However, DPCS implementation relies on species selection and management practices. The selection of complementary species with functional traits that enhance resource utilization is crucial for addressing specific environmental constraints and management conditions. This facilitates asynchronous growth and overyielding, where different species reach their peak growth at different times, a key ecological mechanism that promotes more stable pasture production throughout the year and reduces seasonal yield fluctuations. In addition, future studies should attempt to bridge the gap between theoretical understanding and practical application, especially concerning altered climatic conditions and economic sustainability.

Keywords: *Asynchronous growth, Climate change adaptation, Diverse Pastures Complementary Species (DPCS), Drought tolerance, Over-yielding*