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Pasture development in Guizhou province : 25 years of New Zealand—China co-operation

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Introduction Guizhou situated in south west China at latitude 26° N has karst mountain terrain with an average altitude 1000 m asl and an area of 176 ,000 km² . The climate is subtropical monsoonal with annual rainfall of 1000 to 1400 mm , 75% falling during May to July . Mean summer temperatures are 25°C ; and winter 3 to 5°C with light frosts . The undeveloped hill land soils are generally acidic , (pH 4.5 to 5.5 with high aluminium) , although 30% are limestone soils (pH 6.0 to 6.5) , deficient in phosphorus (P) , occasional potassium (K) and low in organic matter . There are seven million farmers with ruminant livestock consisting of 8 m cattle , 0.4 m sheep and 4 m goats .

New Zealand (NZ) projects Eight projects involving NZ consultants have formally trained >400 pasture-livestock technicians . The projects include the Dushan Model Farm (1983-88) ; UNDP Southern Grasslands (1989-94) ; Massey University-Guizhou University co-operation (1990-present) ; Integrated Land Use Systems (1992-97) ; International Standard Production Systems (1999-2002) ; Massey University-Dushan Model Farm staff exchange (2001-present) , Milk Hygiene (2002-04) ; Livestock Improvement in Karst Mountain Communities (2007-10) . Forty technicians have also trained in NZ .

Key pasture technologies and key impacts Pasture technologies adopted on a wide scale include (i) integration of crop land for winter forage production by sowing rice paddies and maize land after harvest with annual ryegrass (*Lolium multiflorum*) , vetch (*Vicia sativa*) , Chinese milkvetch astragalus (*Astragalus sinicus*) , oats (*Avena sativa*) or triticale (*Secale cereale*) ; (ii) hill wasteland improvement with pasture mixes of perennial ryegrass (PRG) (*L. perenne*) , cocksfoot (*Dactylis glomerata*) and white clover (*Trifolium repens*) ; however PRG only persists for 2 to 3 years . Successfully demonstrated but not widely adopted because of seed supply constraints were the use of Yorkshire fog (*Holcus lanatus*) , tall fescue (*Festuca arundinacea*) , prairie grass (*Bromus willdenowii*) and oversowing with *Lotus pedunculatus* . (iii) alfalfa (*Medicago sativa*) fall dormancy rating 4 to 6 on soils with pH 6.5 to 7.0 using USA cultivars as pure sowings and sown under fruit trees ; (iv) chicory (*Chicorium intybus*) as a special purpose forage for both ruminants and pigs and in mixtures with alfalfa ; (v) small scale silage production for village farmers using whole cob corn , corn stover and grass/clover using mini-bunkers (from 1985) and plastic-bag silage (from 1990) ; (vi) integrated farming systems including controlled grazing by tethering , or biological fenced areas and 24-hour grazing practiced since 1985 .

Winter annual forage and legume green manure sowings are now 533 ,000 ha/year , while permanent pasture sowings total 200 ,000 ha , with annual sowing in 2007 of 20 ,000 ha , both starting from a zero base in 1983 .

Future directions The future focus includes (i) expanded use of soft leaf continental type tall fescue demonstrated as more persistent than ryegrass ; (ii) defining an appropriate summer grass although preliminary trials suggest *Hermarthia compressa* , *Setaria sphacelata* , *Pennisetum purpureum* all survive winter , while local *Paspalum* species should be developed ; (iii) development of inter-planting (e.g. vetch or alfalfa inter-planted in corn) and pre-harvest sowing of winter forages in rice paddies to increase winter production ; (iv) evaluation and inter-cropping of forage brassica species ; (v) development of larger scale farmer co-operatives providing either forage or milk to company enterprises ; (vi) village based seed production to meet seed demands , especially for species not regularly produced internationally .

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