Breeding Sustainable Forages for Alpine Areas in Qinghai Province

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Introduction The fencing of degraded rangelands , the desertification , erosion and salinisation of soils and the expansion of other agricultural restrictions resulted in the increase of grazing pressure in the highlands of Qinghai where average altitude , is 4000m (Luo 2001) . However , there is a great potential for increasing livestock production by planting improved forages and distributing animals wisely in existing rangelands (National Research Council 1992) . Seeds produced from Qinghai" bred varieties of Elymus gradually lost persistency under grazing (Zhou 2006) . This might be inherent to the species but also to the selection for seed yield . The natural germplasms were used to breed new varieties adapted to heavy and temporary grazing in the highlands of Qinghai this breeding program .

Materials and methods The experiment was carried out in 2003-2007 at the Forage Centre of Grassland Institute of Qinghai , Xining (N36°43′ , E101°45′) where annual average temperature is 5 .5℃ , altitude is 2295 .2m , average month temperature in January is -7 .9℃ with lowest -19 .5℃ , while average and highest temperatures are -16 .8℃ and 30 .1℃ in July , Average annual precipitation and evaporation are 402 .33mm and 1310 .8mm respectively . Average annual relative humidity is 56% , sunshine is 2618 .3hrs a year , frost-free time is 150d and soil is chestnut . *The applied method of collecting sprouts in heavily grazed pastures permits to focus on species suited for intensive grazing* . 466 individual plants were transplanted into the experiment fields in 2003 at Xining and Gangcha , then were observed and recorded . The seeds of 177 valuable original breeding materials were selected and collected in the every year (27 from Gangcha shown with G , and 150 from Xining shown with X) . All these 177 original breeding material were planted in the Forage Centre at Xining in 2004 , including 99 varieties of Elymus L . , 9 Deschampsia Beauv , 15 Poa L . , 49 Puccinellia Parl . , 1 Koeleria Peers , 2 Agrostis Roth , -and 2 Agropyron J .

Results There was the shorter growing period for *Elymus sibiricus* , *Puccinellia hauptiana* and Deschampsia species (185 days) than others , but the longer growing period for *E . cylindricus* and *P . tenuiflora* (193 days) . Elymus dahuricus and cylindricus had the highest growth height (135cm without inflorescence) and hay yield in this trial , -Puccinellia hauptiana (226) and P . distans (169) showed the biggest shoot numbers , but had the lowest hay yields (25gr ./plant) , shortest leaf length (6 ,8 cm) and the earliest emergence in ear (on 28th May) in all the varieties . *Puccinellia tenuiflora* and *P . roborovski* weare suited for grazing and for use for hay production . *Puccinellia roborovski and tenuiflora* were distinguished from others of *Puccinellia* in this trial based on its relatively later ear emergence (11th June-8th of July resp .) , relatively longer leaves and higher hay yield .

Conclusions 27 lines of *Elymus nutans and sibiricus* , 9 of *E . dahuricus and cylindricus* , 6 lines of *Puccinellia roborovski and P . tenuiflora* and 9 of *P . distans and hauptiana should be evaluated further* . Elymus cylindricus can be selected as a promising variety for hay production due to its longer growing period and high yields , while . Puccinellia hauptiana and P . distans can be used at saline conditions .

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