

Redesigning farm strategies: Principles & practices

The Team
(Coordinated by David Michalk)



Australian Government
Australian Centre for
International Agricultural Research



Developing appropriate strategies

Key Questions

- ❑ What principles have emerged from the case studies that can be used to provide better solutions for small-holders to adopt? It is to:
 - change enterprise,
 - Improve management of current enterprise;
 - or both?
- ❑ What transition pathways are possible to minimise costs?
 - One step change; or
 - phased change?
- ❑ How can re-organising the farm contribute to rehabilitation of grasslands.
 - Are loop-back responses strong enough to achieve improvement?

Several principles are developing as a result of our workshops, herder visits, modelling and general discussions. These are outlined here for further discussion and to provide focus for the future modelling work.

Current resources & enterprises

Key parameters	Experimental sites			
	Siziwang	Taipusi	Sunan	Huanxian
Grassland type	Desert steppe	Typical steppe	Desert steppe to alpine meadow	Typical steppe
Farm size	800 ha	33 ha	134 ha	74 ha
Livestock	Mongolian mutton sheep	Mutton sheep	Fine wool Gansu Alpine	Tan mutton sheep
Breeding ewes (EU)	180	50	88	60
Stocking rate	0.225 EU/ha	1.52 EU/ha	0.71 EU/ha	1.9 EU/ha (grassld only)
Income	RMB13,000	RMB8000	RMB17,591	RMB11,000
Income/EU	RMB72/EU	RMB160/EU	RMB200/EU	RMB183/EU
Income/ha	RMB16.25/ha	RMB242.42/ha	RMB131.28/ha	RMB366.67/ha (grassld only)

Challenge for redesigning farm strategies

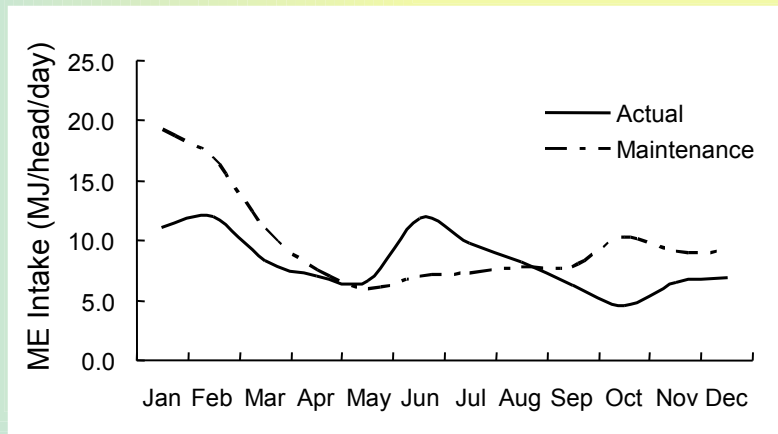
Main challenge: Efficient use of limited forage resources

Current situation assessment:

- ❑ Inefficient use of limited energy resources due to a poor match between feed supply and livestock feed requirements
- ❑ Little flock segregation and differential feeding programs (e.g. pen-fed lambs)

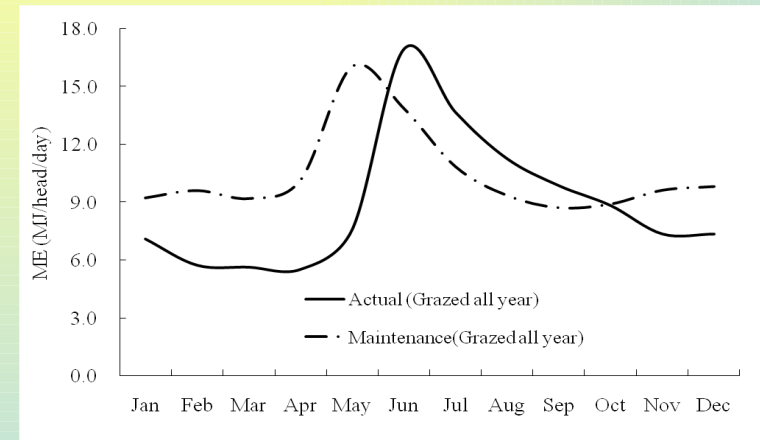
Taipusi County

Mutton production & January-March lambing



Sunan County

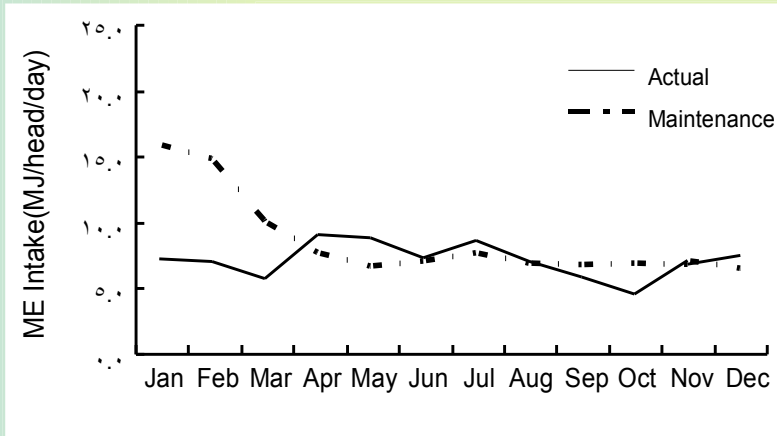
Fine wool production & April lambing



Current situation assessment:

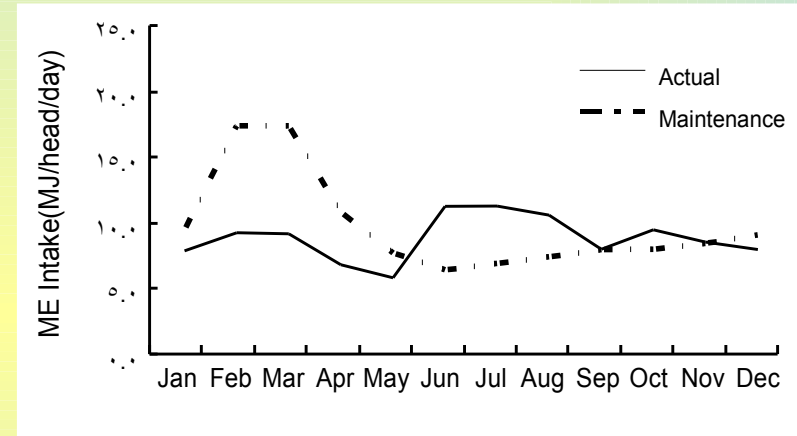
Huanxian County

Mutton production & December lambing



Siziwang County

Mutton production & February lambing



Re-designing farm strategies: Main objectives

Re-design livestock systems to achieve four main objectives:

- ❑ Maintain or improve profitability of herders;
- ❑ Significantly reduce stocking rate;
- ❑ Rehabilitate grasslands; and
- ❑ Change policy focus from livestock numbers to product output/resource unit.

Current livestock production activities

- ❑ **Current livestock activities considered best because they have evolved over a long period – traditional practice is best;**
- ❑ **Based on use local breeds that are considered to be well adapted to climatic and grassland conditions;**
- ❑ **Transhumance (spring/autumn; summer; winter pastures) or often rotational grazing practiced; and**
- ❑ **All the flock/herd (ewes & lambs) are move from pasture to pasture (i.e. poor development of production/industry specialization).**

Principle 1: Select the best enterprise

Question: Can changing the current livestock enterprise to something different:

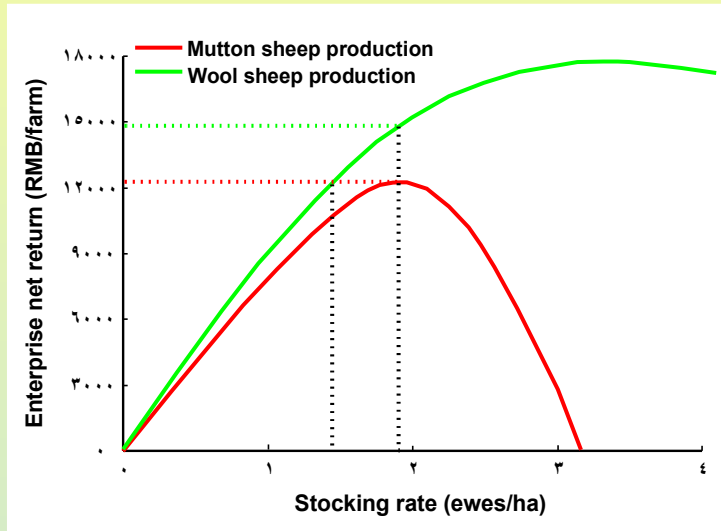
Increase profit at same SR?

OR

Maintain profit at lower SR?

Predicted effects of enterprise change

Huanxian County



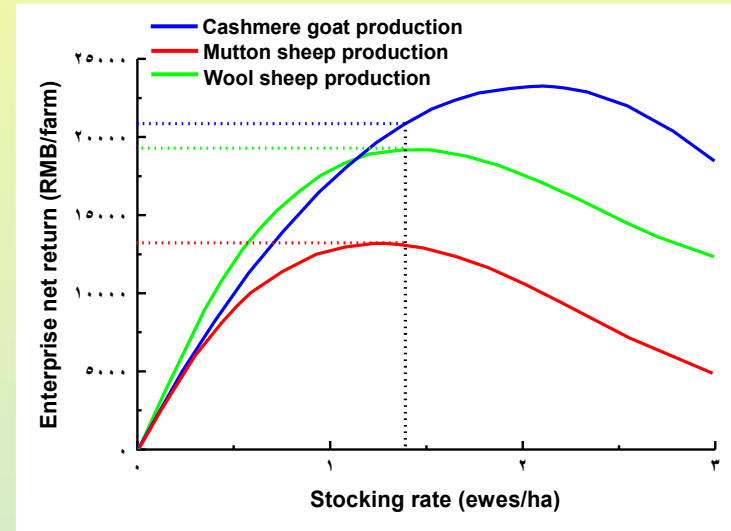
At optimal SR for mutton sheep:

Wool sheep - 20% increase in Net Farm Return

At current Net Farm Return for mutton sheep:

Wool sheep - 25% SR reduction

Sunan County



At optimal SR for wool sheep:

Mutton sheep - 35% decrease in Net Farm Return

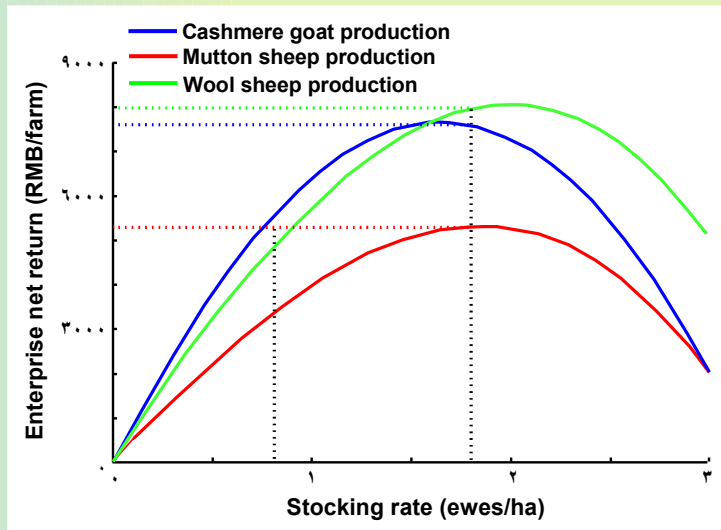
Cashmere goats - 17% increase in Net Farm Return

At optimal Net Farm Return for wool sheep:

No significant reduction in SR by changing to cashmere goats

Predicted effects of enterprise change

Taipusi County



At optimal SR for mutton sheep:

Wool sheep/goats - 50% increase in Net Farm Return


At current Net Farm Return for mutton sheep:

Wool sheep/goats - 55% SR reduction

Conclusion: consider enterprise change

Modelling suggests investigation of changing livestock enterprise is warranted to achieve an increase in profitability, a reduction in SR, or both

Huanxian
Taipusi
Siziwang?

POTENTIAL

FOR CHANGE

+

MUTTON

FINE WOOL

MUTTON

POTENTIAL

FOR CHANGE

Still to be tested

MUTTON

BEEF CATTLE

Principle 2: changing management to improve efficiency of current enterprise

Question: Can efficiency gains achieved by changing key livestock management practices:

Increase profit at same SR?

OR

Maintain profit at lower SR?

Management tactics to improve reproductive efficiency

❑ Improving weaning rate

- Only ewes that rear lambs should be retained.
- Tagging and weighing all animals is needed to identify non-productive ewes to cull
- Develop and use fat scoring as management tool

❑ Changing time of lambing

- Lambs are often born in winter and early spring under conditions where ewes are losing weight due to inadequate nutrition
- Can lambing time be changed to match high ewe demands with better quality forage supply?

❑ Early weaning of lambs

- At what age can lambs be successfully weaned?
- What is the impact of ewe performance?

Management tactics to improve reproductive efficiency

Data from experimental sites:

Key parameters	Experimental sites			
	Siziwang	Taipusi	Sunan	Huanxian
Livestock	Mongolian mutton sheep	Mutton sheep	Fine wool Gansu Alpine	Tan mutton sheep
Breeding ewes (EU)	180	50	88	60
Wethers	5	10	0	0
Weaning rate	70% (Natural breeding)	80% (Natural breeding)	90% (Artificial breeding)	79% (Natural breeding)
Lambing	March	January-March	April-May	January
Feeding costs	RMB 12,000	RMB1000	RMB400	RMB1,500
Feed cost/EU	RMB66.67/EU	RMB20.00/EU	RMB4.54/EU	RMB25.00/EU

Improving weaning rate strategy:

Suitable for Siziwang, Taipusi & Huanxian

Changing time of lambing:

Suitable for Taipusi & Sunan

Adoption of early weaning:

All sites

Predicted effect of increasing weaning rate

Improving weaning rate strategy: Application to Siziwang

(1) Increase lamb crop

Improving weaning rate will:

- increase lamb sale revenue
- reduce feed consumed by ewes not producing lambs
- **BUT** would increase effective SR (depending on weaning rate) even if all ewes that don't lamb are culled at 90% weaning rate

Weaning rate (%)	Size ewe flock	Lambs weaned	Non-performing ewes	Feed cost of non-performing ewes (RMB)
70	180	126	54	3600
80	180	144	36	2400
90	180	162	18	1200

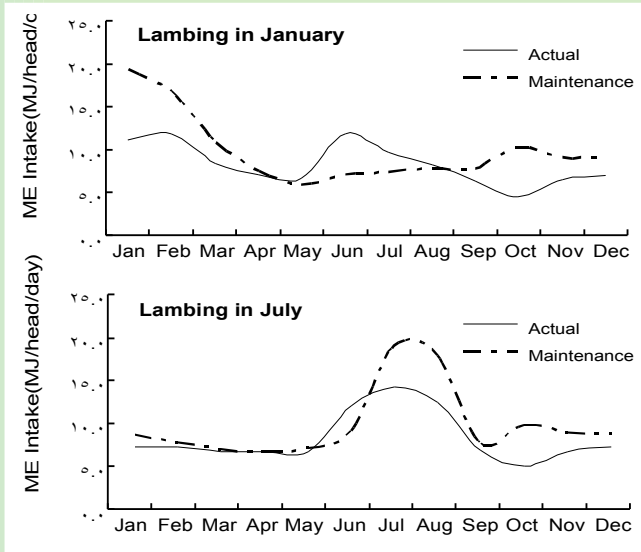
(2) Maintain current lamb crop & reduce ewe flock

Weaning rate (%)	Size ewe flock	Lambs weaned	Non-performing ewes	Feed cost of non-performing ewes (RMB)	Reduction in ewe flock	Feed cost saved by reducing ewe flock (RMB)
70	180	126	54	3600		
80	157	126	31	2067	23	1533
90	140	126	14	934	17	1134

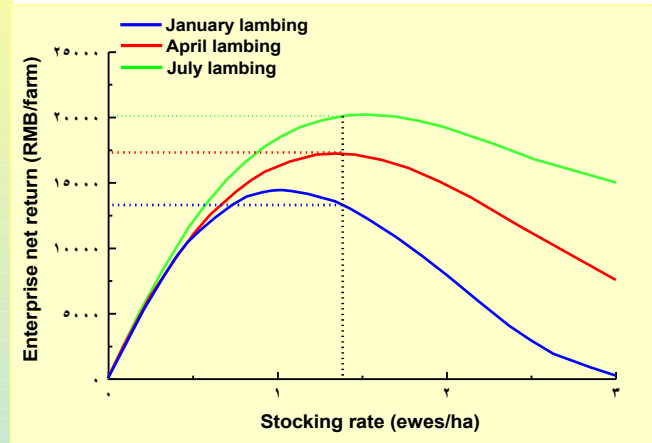
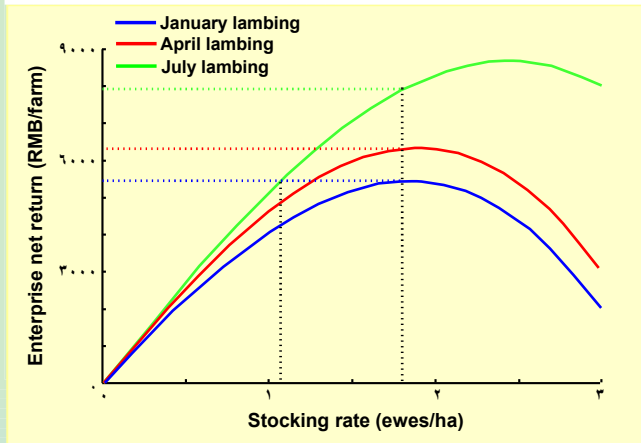
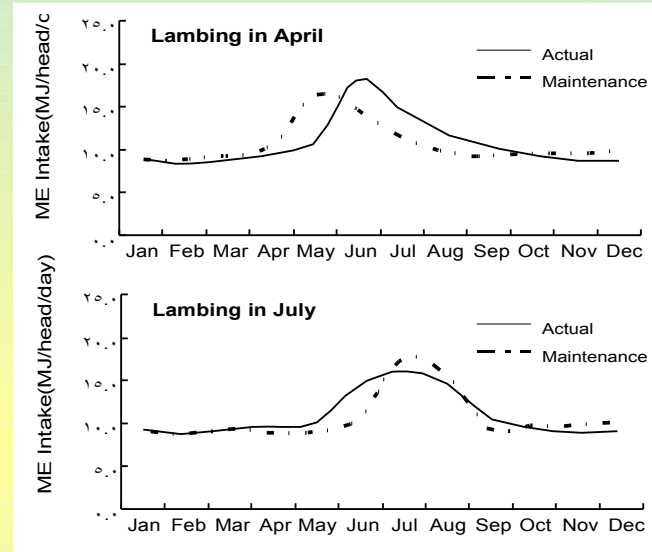
- reduce ewe flock but maintain current lamb crop could reduce SR by 13% & 22% at 80% & 90% weaning rate, respectively.

Predicted effect of changing lambing time

Taipusi County



Sunan County



- July lambing significantly increases lamb liveweight produced and net return compared to current lambing time

Predicted effect of early weaning

Effects on lambs

- ❑ Lambs weaned at 30, 45 & 60 days grew faster than unweaned lambs
- ❑ Mean daily gain from Day 75 to 120 was 277 g/day compared with 145 g/day for unweaned lambs

Liveweight (kg) at	Unweaned	Weaned at :		
		30 days	45 days	60 days
Day 75	13	16	17	19
Day 120	24	29	34	37

Effects on ewes

- ❑ Early weaning maintained ewe body condition
- ❑ For example, weaning at 30 days increased ewe liveweight by 5.2 kg at Day 120 compared to ewes with lambs
- ❑ Increased breeding efficiency with ewes returning to oestrus 30 days earlier than ewes with lambs

Conclusion

- ❑ Early weaning provides an economic means to increase weaning rate by maintaining ewes in better condition;
- ❑ This could result in reduced ewes flock size and at the same time maintain or increase net farm income.

Management tactics to improve feeding efficiency

- ❑ **Tactical use of pen feeding**
 - Pen-feeding is being used more by small households and specialized producers.
 - Pen feed in the October to May period to meet target liveweights for payments premiums.

- ❑ **Development of least-cost rations**
 - Improve the quantity & quality of stored forage (*e.g.* silage)
 - using hay, stover, silage, grain
 - optimal area of lucerne, maize

- ❑ **Efficient use of greenhouse sheds**
 - What is the impact on liveweight over winter?
 - What is the cost benefit?

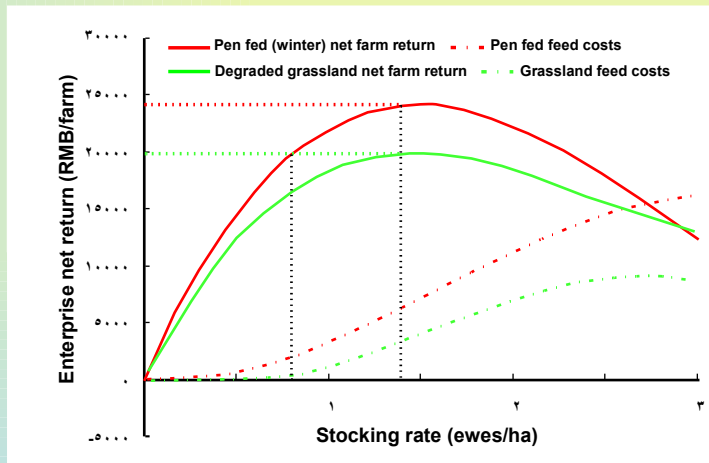
Combined effect of pen feeding & warm sheds

Effects of warm shed on livestock performance

- All classes of animals gain weight over winter
- Impact greatest when base nutrition is moderate to low

Indicator parameters	Livestock in Warm shed			Livestock on conventional shed		
	Adult Ewe	Replacement ewe	Lamb	Adult Ewe	Replacement ewe	Lamb
Mean initial liveweight (kg)	43.0	31.8	21.0	42.4	30.1	23.4
Mean final liveweight (kg)	48.6	41.6	27.9	30.1	20.1	22.4
Mean liveweight gain (kg)	5.6	9.8	6.9	-12.3	-10.0	-1.0
Liveweight gain (%)	12	31	33	-29	-33	-4

- Combination of warm shed & pen feeding could increase income at current SR or maintain current net farm return at lower SR



Value of artificial pastures as low cost rations

Village		Alfalfa	Maize	Wheat	Flax	Peas/beans
Sitan	Current	0	10	20	0	10
	Optimal	0	10	30	0	0
Yongtai	Current	0	0	20	20	0
	Optimal	1	0	40	9	0
Kuangou	Current	0	0	20	0	10
	Optimal	0	0	30	0	10
Xindongwang	Current	0	0	10	0	0
	Optimal	2	0	10	3	0

Modelling shows that growing crops, hay and silage or purchasing fodder to meet livestock requirements at critical times increases net farm return

Use of model in Jingtai County selected alfalfa in all villages where no alfalfa was grown, increased wheat and reduced peas/beans

Value of artificial pastures as low cost rations

Demonstrations using artificial pastures (oats, sainfoin, alfalfa, forage maize) show:

- ❑ production efficiency and income/animal of demonstration households was higher than control households.
- ❑ This meant that demonstration households could **maintain the same income** as control households with:
 - 25% fewer sheep and 10% fewer goats in Suzhou district,
 - 16% fewer sheep in Anding district, and
 - 21% fewer goats in Liangzhou County.

Conclusion

Growing artificial forage can:

- ❑ substantially improve production efficiency; and
- ❑ effectively decreasing the number of EUs, but maintain household profitability.

Precision management tactics to improve quality of livestock products

□ Production decision

- Decide on the livestock product and select/breed animals that best meet the objective – *e.g.* meat or fibre
- Decide on the production system – *e.g.* breeding or finishing
- Difficult for small households to efficiently breed and finish animals to meet increasing specific market grades – development of specialised households needed

□ Product quality

- Select for wool yield and fibre diameter
- Select ewes based on lamb growth rate
- Develop and use fat scoring as management tool

□ Genetic improvement

- Purchase of good quality sires with known performance
- Use of terminal sires to increase growth or change products conformation (*e.g.* less fat in prime lamb)

The effect of impact of focus on product quality or genetic improvement still need to be incorporated in the models

Principle 3: Changing management to improve grassland condition

Question: Can grassland degradation be reversed and productivity increased by changing management practices & at the same time:

Increase profit at same SR?

OR

Maintain profit at lower SR?

Grassland management

Management tools for grassland improvement include:

- ❑ Change stocking rate – SR reduction will release extra biomass to:
 - sustain remaining animals and/or
 - contribute to re-building ecosystem function
- ❑ Change grazing season – Strategic rests will increase potential for:
 - biomass production (early spring rest)
 - Species recruitment
 - Retention of cover at critical time
 - Change species composition over time

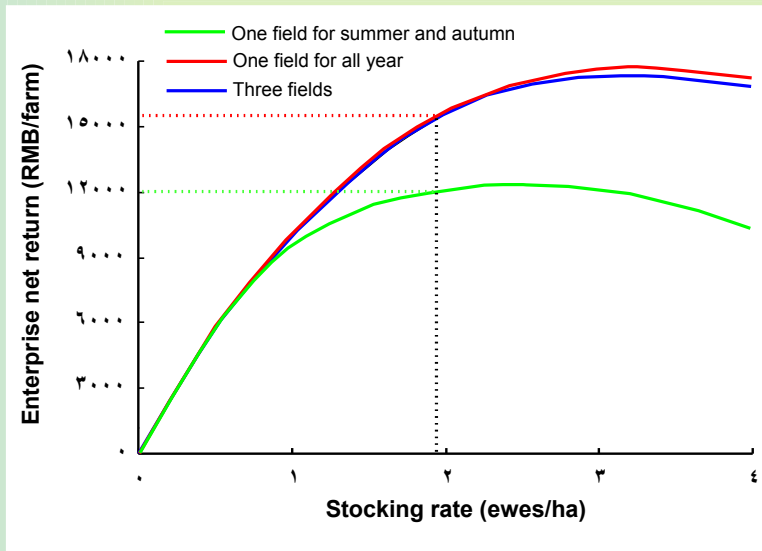
Prospects to reduce stocking rate

Principle or management factor	Cavet	Experimental sites			
		Huanxian	Sunan	Taipusi	Siziwang
Change enterprise	Maintain current net farm return	Change to wool Reduce SR 25%	No change	Change to wool Reduce SR 25%	?
Increase weaning rate (WR)	Maintain current net farm return	?	?	?	70 to 90% WR Reduce SR 22%
Change lambing time	Maintain current net farm return	?	Reduce SR 35%	Reduce SR 38%	No difference Negative at high SR
Early weaning (45 days)	?	Increases weaning rate through early return to oestrus and better ewe condition			
Pen feeding & warm shed combination	Maintain current net farm return	?	Reduce SR 42%	?	?
Artificial pastures	?	Demonstrations indicate reduction in SR of 10 to 25%, depending on current grassland condition			
Precision management (genetics for wool & meat quality; LWG)	?	Expected to increase product output, product quality and profitability/EU			

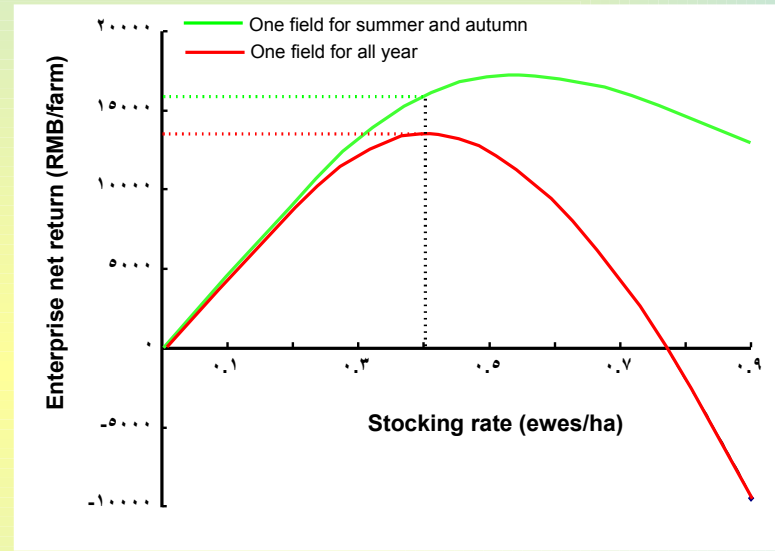
Analyses using project models complemented with field demonstrations have identified a large number of options available that livestock producers can use to reduce ewe flock but maintain current net farm returns

Effect of change in grazing season

Huanxian County – typical steppe



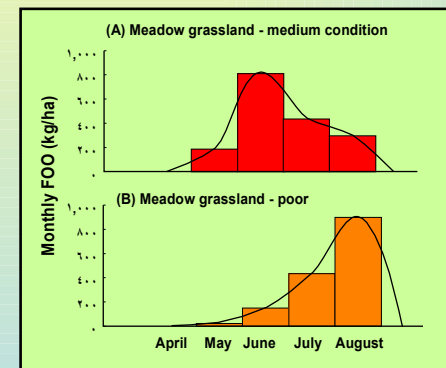
Siziwang County – desert steppe



Change grazing season has differential effect from strategic rests due to:

- Grassland type
- Grassland condition

More research needed to understand the time frame of grassland improvement and reduction in SR – this can be explored by using the Stage 3 Model



Key conclusions

Management tools identified to improve sustainability of small livestock producers in Western China include:

- ❑ Change in livestock enterprise
- ❑ Change in management of current enterprise
- ❑ Change in grazing season

Changing management in these three key areas have the potential to achieve significant SR reductions across a range of grassland types/conditions and sheep enterprises that could:

- ❑ achieve positive impact on grassland condition and productivity; and
- ❑ Maintain or increase household income

Principle 4: knowledge empowers people to change

❑ Farmer practice

- Effective participatory demonstrations of the new information and practices described above
- Accurate and timely market information linking quality, consumer preference and price
- Financial institution support with loans with 3 to 5 year maturity, especially to achieve industry specialization

❑ Local and regional government perspectives

- Encourage change from emphasis on livestock number to production efficiency (product output/resource unit)
- Promote appropriate industry restructure
- Develop 'bottom-up' extension programs

❑ Capacity of scientists & student technology base

- Training programs & workshops on development & use of models
- Training on grassland measurement & livestock monitoring