

Role of agriculture in the livelihoods of farm households in Tibet

Colin Brown and Scott Waldron



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Background/Context

- ACIAR Project LPS/2006/119 entitled “Integrated crop and dairy systems in Tibet Autonomous Region, PR China”
- “Modernise” & develop agricultural production
- Agrarian change



Lhasa

Mozhugongka

Bailang

Naidong

Agricultural areas



Crop systems



Livestock



Dairy



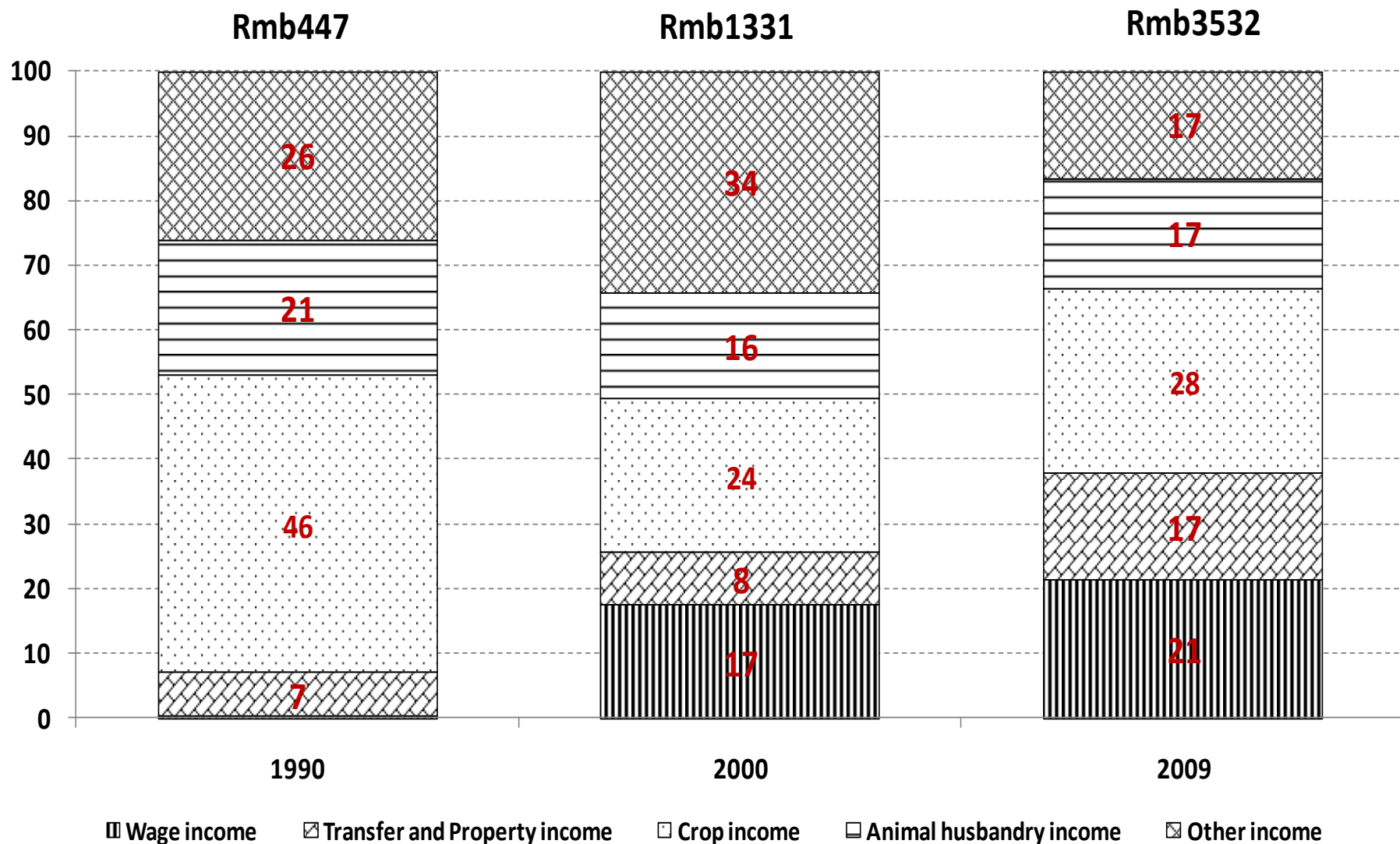
Specialisation



Increasing commercialisation



Changing source of incomes



Source: 2010 Tibet Statistical Yearbook

Non-farm income



Modeling approach

Model

Optimisation model
(*CAEGTibetLP*)

Simulation model
(*CAEGTibet*)

Purpose

- * Identify potentially worthwhile crop and livestock activities and feed rations
- * Identify the importance of particular household constraints

Examine impacts and feasibility of activities on household system

Features

- * Optimal feed rations
- * Substitution within crop, livestock and feed activities to changing prices
- * Shadow prices and opportunity costs on household resources and "sub-optimal" activities

- * Detailed and disaggregated impacts on household / farm systems from particular activity selection and household choices
- * Reconciliation on monthly basis of cash flow, labour, crop outputs, livestock numbers, livestock products, livestock feed and manure; as well as various returns

Inter-relationships

Share much common data
Optimisation model constrained by household decision making while simulation model can readily scan response surface

CAEGTibet Front Page

Instructions:

1. Use the grey buttons to navigate around the input and output worksheets.
2. Use the first red buttons to delete the output sheets to prepare for a new model run and the second red button to run a new scenario.
3. A feed deficit option is also provided that allows for reduction in feed rations and a commensurate reduction in livestock productivity. The proportional feed deficit is given here in cell B24 while the productivity impacts are input on the livestock productivity sheet. Note that cell B24 may be left blank as well in which case no feed shortfall will be assumed.
4. The number of feed iterations just allows for more years to be run to achieve a steady state situation (note that it can be left blank in which case a default value of 5 will be used.)

Input sheets

Own consumption
Financial
Subsidies
Prices
labour parameters
Land use
Cropping
Livestock numbers
Livestock parameters
Milk/dairy products
Livestock rations

Output sheets

Net Profit
Cash flow
crop reconciliation
labour reconciliation
Livestock reconciliation
Feed reconciliation
Manure reconciliation
Livestock products reconciliation

Programs

Delete output sheets

Run main program

Feed deficit-productivity impact

The model also has the option of specifying a proportional feed deficit that will then be combined with set parameters to determine livestock productivity. Set the proportional deficit in the box below.
(e.g. an 80% feed deficit indicating livestock are only fed 80% of their rations should be listed as "80" in the box [cell B24] below.)

80 Proportional feed deficit

Miscellaneous

Number of feed loop iterations

5

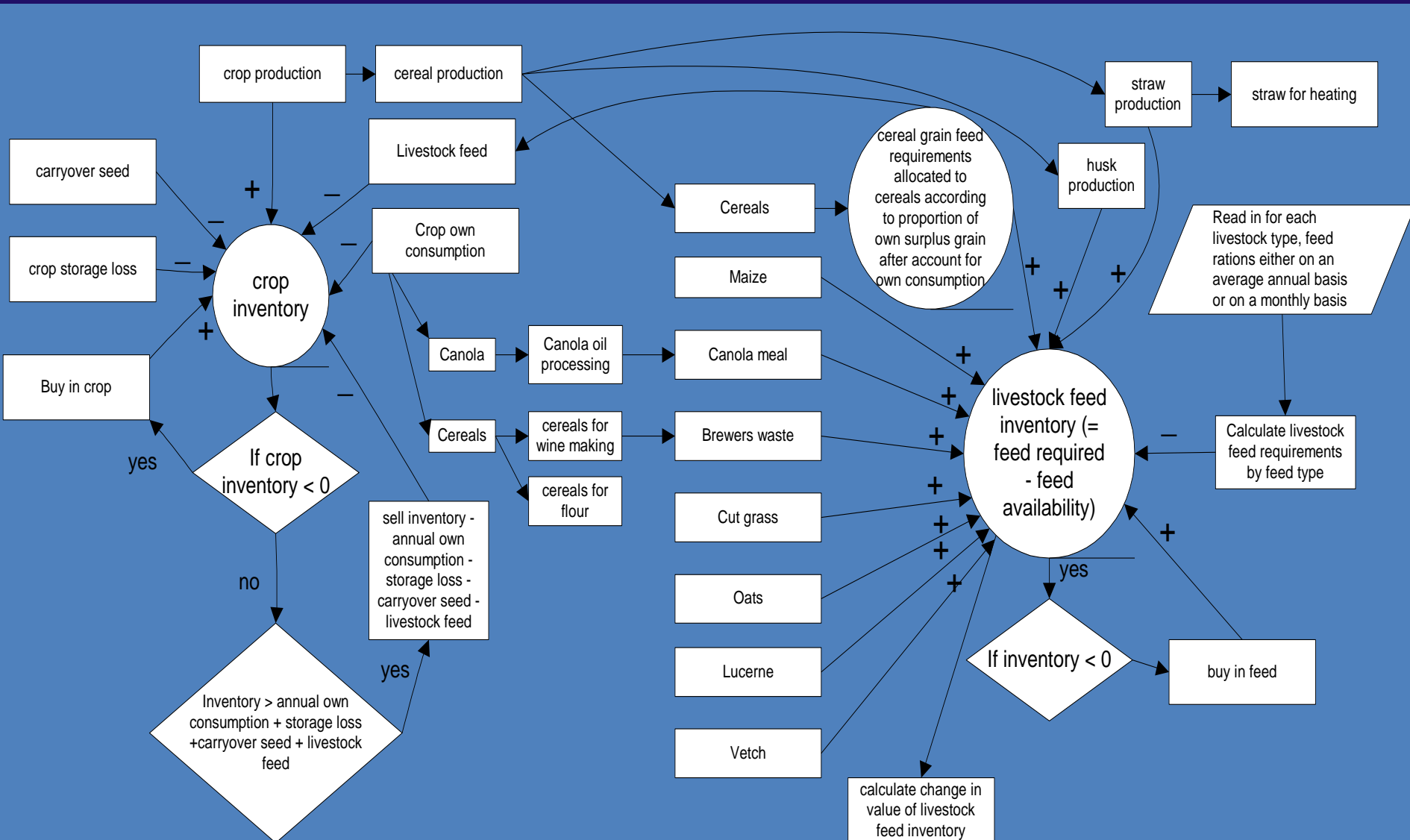
CAEGTibet

' calculate livestock reconciliation

```
For i = 1 To mlive
  Inum(i, 1) = (Inum(i, 15) + ltrade(i, 1)) * (1 - lprod(i, 6))
  If Inum(i, 1) < conl(i, 1) Then
    For k = 1 To 100
      If Inum(i, 1) + k < conl(i, 1) Then
        Else
          ltrade(j, 1) = ltrade(j, 1) + k
          Inum(i, 1) = Inum(i, 1) + k - conl(i, 1)
        GoTo ljump
      End If
    Next k
  ljump:
  Else
    Inum(i, 1) = Inum(i, 1) - conl(i, 1)
  End If
  For j = 2 To 12
    Inum(i, j) = (Inum(i, j - 1) + ltrade(i, j)) * (1 - lprod(i, 6))
    If i = 3 Then
      If Inum(1, 16) = j Then
        Inum(3, j) = Inum(3, j) + Inum(1, j) * lprod(1, 7) * (1 - lprod(3, 6)) * 0.5
      Else
        End If
      Else
        End If
    End If
  End If
```

- Simulation model
- Steady state, annual model
- Monthly time unit
- Representative household model but with implicit village level constraints
- Visual basic model embedded in Excel spreadsheet
- Detailed profit and monthly cash flow statements
- Monthly reconciliations of labour, crops, livestock, feed, livestock products and manure

Crop-livestock feed reconciliation



CAEGtibet Front Page

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4. The number of feed iterations just allows for more years to be run to achieve a steady state situation (note that it can be left blank in which case a default value of 5 will be used.)

Input sheets

Own consumption
Financial
Subsidies
Prices
labour parameters
Land use
Cropping
Livestock numbers
Livestock parameters
Milk/dairy products
Livestock rations

Output sheets

Net Profit
Cash flow
crop reconciliation
labour reconciliation
Livestock reconciliation
Feed reconciliation
Manure reconciliation
Livestock products reconciliation

Programs

Delete output sheets

Run main program

Feed deficit-productivity impact

The model also has the option of specifying a proportional feed deficit that will then be combined with set parameters to determine livestock productivity. Set the proportional deficit in the box below.

(e.g. an 80% feed deficit indicating livestock are only fed 80% of their rations should be listed as "80" in the box [cellB24] below.)

80

Proportional feed deficit

Miscellaneous

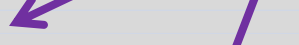
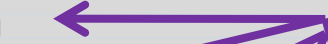
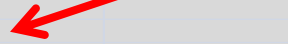
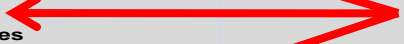
Number of feed loop iterations

5

Profit/Loss statement

Notes: (1) The values in Column I are the percentages of major revenue/cost categories, while the values in Column j are the percentage of the sub-heading revenues/costs categories.
 (2) The values in red in Column H are the implicit values of own consumption. They are not included in the direct value of own consumption as they are accounted for elsewhere in terms of reduced input costs.

	Rmb	Rmb	Rmb	Rmb	%	%
1. Total Revenues	18799.48					
1.1 Increase in value of inventories		5750.85			30.6	
Livestock inventory			5691.81			99.0
Feed inventory			59.05			1.0
1.2 Sales		5462.63			29.1	
Dairy product sales			87.84			1.6
Other livestock product sales			856.79			15.7
Crop sales			4518.00			82.7
1.3 Value own consumption		7586.00			40.4	
Livestock			280.00			3.7
Dairy products			3780.00			49.8
Other livestock products			720.00			9.5
Crop products			1470.00			19.4
Straw for heating			103.50			1.4
Manure for heating			232.50			3.1
Value of livestock draught			1000.00			13.2
Manure for fertiliser				166.17		
Livestock feed				2445.44		
Carryover seed				270.00		
2. Total Costs	8006.18					
2.1 Decrease in value of inventories						0.0
2.2 Purchases		4836.56			60.4	
Dairy product purchases			803.73			16.6
Crop purchases			362.39			7.5
Livestock feed purchases			3670.44			75.9
2.3 Variable costs		1416.70			17.7	
Livestock variable costs			477.50			33.7
Crop variable costs			939.20			66.3
2.4 Transport costs		233.12				2.9
2.5 Service processing costs		104.80				1.3
2.6 Land fees		240.00				3.0
2.7 Repairs and maintenance		175.00				2.2
2.8 Depreciation		1000.00				12.5
3. Return to management, labour and capital [=1-2]	10793.30					
3.1 Interest/Opportunity cost of capital		250.00				
4. Return to management and labour [=3-3.1]	10543.30					
4.1 Opportunity cost of own labour		13290.44				
4.2 Opportunity cost of village labour used		29.05				
5. Return to management [=4-4.1-4.2]	-2776.19					
5.1 Off-farm wages		8850.00				
6. Return to management (including off farm income) [=5+5.1+5.2+5.3]	6073.81					
7. Return to management and labour (including off farm income) [=4+5.1+5.2+5.3]	19393.30					
7.2 Subsidies		2817.67				
Agricultural subsidies		817.67				
Livestock subsidies			313.67			
Crop land subsidies			420.00			
Other crop subsidies			84.00			
Other subsidies		2000.00				
Housing subsidies			2000.00			
8. Return to management & labour (incl. off-farm income,taxes&subsidies)[=7-7.1+7.2]	22210.97					





Cash Flow

	Rmb														
	January	February	March	April	May	June	July	August	September	October	November	December	Annual	%	%
1. Cash receipts	2241.10	240.54	239.99	1748.43	2188.88	2608.33	2232.51	1330.34	761.69	4754.15	235.61	548.74	19130.30		
Crop sales										4518.00			4518.00	23.6	
Oilseed										4518.00			4518.00		100.0
Dairy product sales							44.73	43.11					87.84	0.5	
Butter sales							18.18	17.28					35.47		40.4
Cheese sales							26.55	25.83					52.37		59.6
Other livestock product sales	74.44	73.88	73.32	72.76	72.21	71.66	71.11	70.57	70.02	69.48	68.94	68.40	856.79	4.5	
Egg sales	74.44	73.88	73.32	72.76	72.21	71.66	71.11	70.57	70.02	69.48	68.94	68.40	856.79		100.0
Off-farm wages				1425.00	1950.00	1950.00	1950.00	1050.00	525.00				8850.00	46.3	
Loan receipts	2000.00												2000.00	10.5	
Subsidies	166.67	166.67	166.67	250.67	166.67	586.67	166.67	166.67	166.67	166.67	166.67	480.34	2817.67	14.7	
Livestock subsidies												313.67	313.67		11.1
Crop land subsidies						420.00							420.00		14.9
Other crop subsidies				84.00									84.00		3.0
Housing subsidies	166.67	166.67	166.67	166.67	166.67	166.67	166.67	166.67	166.67	166.67	166.67	166.67	2000.00		71.0
2. Cash Payments	1268.68	1671.81	1563.30	2504.25	1381.70	1398.27	1371.46	1368.96	922.39	1127.39	992.32	1035.64	16606.18		
Crop purchases	0.00	32.39	55.00	55.00	55.00	55.00	55.00	55.00	0.00	0.00	0.00	0.00	362.39	2.2	
Spring barley	0.00	32.39	55.00	55.00	55.00	55.00	55.00	55.00	0.00	0.00	0.00	0.00	362.39		100.0
Crop variable costs	0.00	0.00	19.20	920.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	939.20	5.7	
Land preparation			19.20										19.20		2.0
Planting				737.60									737.60		78.5
Organic fertiliser				14.40									14.40		1.5
Inorganic fertiliser				168.00									168.00		17.9
Feed purchases	171.24	497.95	496.03	606.66	354.05	437.15	434.97	432.81	17.82	17.64	48.07	156.05	3670.44	22.1	
Vetch					14.57	43.01	42.82	42.63					143.04		3.9
Cut grass	30.29	30.19	30.08	40.24	8.64	8.60	8.56	8.53	8.49	8.45	39.02	38.85	259.95		7.1
Straw	134.18	133.74	133.31	175.80	57.23	57.01	56.80	56.58				108.29	912.95		24.9
Cereal husks	5.35	9.61	9.57	11.49	11.44	16.49	16.40	16.31					96.66		2.6
Cereal grains		323.08	321.83	369.07	252.27	302.26	300.77	299.29					2168.57		59.1
Brewer's waste	1.42	1.33	1.25	10.05	9.90	9.76	9.62	9.47	9.33	9.19	9.05	8.91	89.28		2.4
Dairy product purchases		274.14	126.48	39.97	95.77	24.52		36.04	130.83	75.97			803.73	4.8	
Butter purchases		157.30	75.27	27.21	59.87	20.29		26.69	79.35	47.21			493.18		61.4
Cheese purchases		116.84	51.21	12.77	35.90	4.23		9.35	51.48	28.76			310.55		38.6
Livestock variable costs	28.40	28.29	28.19	42.39	42.19	44.89	44.67	44.44	44.22	44.00	43.78	42.06	477.50	2.9	
Veterinary costs	17.93	17.87	17.80	27.28	27.15	28.95	28.81	28.66	28.52	28.37	28.23	27.09	306.66		64.2
Other livestock variable costs	10.46	10.42	10.38	15.12	15.04	15.94	15.86	15.78	15.70	15.62	15.55	14.97	170.85		35.8
Transport costs	11.97	21.97	21.32	23.14	17.60	19.63	19.74	19.62	7.23	53.04	7.42	10.45	233.12	1.4	
Crop transport costs		8.08	8.56	9.64	6.98	8.12	8.09	8.05		45.18			102.70		44.1
Feed transport costs	4.52	4.55	4.53	5.96	2.74	4.20	4.18	4.17				3.61	38.46		16.5
Dairy product transport costs		1.95	0.89	0.26	0.66	0.14	0.36	0.34	0.23	0.91	0.52		6.27		2.7
Other livestock product transport costs	7.44	7.39	7.33	7.28	7.22	7.17	7.11	7.06	7.00	6.95	6.89	6.84	85.68		36.8
Service processing costs	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	67.30	2.50	12.50	104.80	0.6	
Repairs & maintenance	14.58	14.58	14.58	14.58	14.58	14.58	14.58	14.58	14.58	14.58	14.58	14.58	175.00	1.1	
Land fees	240.00												240.00	1.4	
General household expenses	400.00	400.00	400.00	400.00	400.00	400.00	400.00	400.00	400.00	400.00	400.00	400.00	4800.00	28.9	
Major household expenses	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	2400.00	14.5	
Loan repayments	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	2400.00	14.5	
3. Monthly net balance (= 1 - 2)	972.42	-1431.27	-1323.31	-755.82	807.18	1210.05	861.05	-38.62	-160.71	3626.75	-756.71	-486.90			
4. Opening cash balance	0.00	972.42	-458.85	-1782.16	-2537.98	-1730.81	-520.75	340.30	301.68	140.98	3767.73	3011.02			
5. Closing cash balance (= 4 + 3)	972.42	-458.85	-1782.16	-2537.98	-1730.81	-520.75	340.30	301.68	140.98	3767.73	3011.02	2524.12			



Labour reconciliation

	January	February	March	April	May	Days June	July	August	September	October	November	December
Labour availability												
Adult labour	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00
Child/Senior labour	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00
Other family/village labour	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Labour use												
General household labour	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Family/village labour obligations	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Off-farm labour					60.00	60.00	60.00					
Adult off-farm labour					30.00	30.00	30.00					
Child off-farm labour					30.00	30.00	30.00					
Cropping labour	0.80	0.80	12.80	27.80	9.90	9.90	8.20	7.80	23.40	21.60		
Land preparation			5.80						0.80			
Planting				11.60						1.60		
Organic fertiliser				4.20						0.80		
Inorganic fertiliser			0.40	2.10			1.60			0.40		
Weeding												
Pest control												
Irrigation				3.30	3.30	3.30						
Harvesting								1.20	16.00	13.00		
General cropping labour	0.80	0.80	6.60	6.60	6.60	6.60	6.60	6.60	6.60	5.80		
Livestock labour	11.95	18.65	19.52	23.51	25.27	31.36	31.20	31.04	28.73	27.66	26.60	17.77
General livestock labour	11.95	11.70	11.65	14.72	14.65	18.91	18.80	18.69	18.28	18.18	18.07	17.77
Milking labour		1.24	1.23	1.23	1.22	1.22	1.21	1.21	1.20	1.20	1.19	
Butter/cheese making labour		5.71	6.64	7.55	9.40	11.23	11.19	11.14	9.25	8.29	7.34	
Casual labour required						1.17	7.26	5.40				
Surplus labour												
Adult labour	49.25	42.55	29.68	10.69				23.16	9.87	12.74	35.40	44.23
Child/senior labour	30.00	30.00	30.00	30.00				30.00	30.00	30.00	30.00	30.00
Unused village/family labour	2.00	2.00	2.00	2.00				2.00	2.00	2.00	2.00	2.00



Crop reconciliation

	January	February	March	April	May	Kilograms		August	September	October	November	December
						June	July					
Winter wheat												
Crop production								1100.00				
Crop own consumption												
Crop livestock feed	63.83	63.56	63.30	75.94	75.57	82.40	81.98	81.55	76.52	76.14	75.76	75.38
Crop sales								148.07				
Crop purchases							0.00					
Crop storage losses												
Carryover seed								60.00				
Crop inventory	442.76	379.19	315.89	239.95	164.38	81.98	0.00	810.38	733.86	657.73	581.97	506.59
Straw production								1265.00				
Husk production								66.00				
Spring barley												
Crop production									4620.00			
Crop own consumption	33.33	33.33	33.33	33.33	33.33	33.33	33.33	33.33	33.33	33.33	33.33	33.33
Crop livestock feed	244.88	243.86	242.84	291.34	289.92	316.12	314.49	312.86	293.55	292.09	290.64	289.19
Crop sales									534.22			
Crop purchases								0.00				
Crop storage losses												
Carryover seed									264.00			
Crop inventory	2244.77	1967.58	1691.40	1366.73	1043.48	694.02	346.20	0.00	3494.90	3169.48	2845.51	2522.98
Straw production									5313.00			
Husk production									277.20			
Oilseed												
Crop production											396.00	
Crop own consumption											216.00	
Crop livestock feed												
Crop sales											168.80	
Crop purchases											0.00	
Crop storage losses												
Carryover seed											11.20	
Crop inventory	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Oats												
Crop production											2160.00	
Crop own consumption												
Crop livestock feed	353.52	342.05	340.62	370.41	123.98	123.34	122.70	122.06	121.43	120.79	451.58	439.19
Crop sales												
Crop purchases	0.00	0.00	0.00	258.17	123.98	123.34	122.70	122.06	121.43	0.00	0.00	0.00
Crop storage losses	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Crop inventory	794.91	452.86	112.24	0.00	0.00	0.00	0.00	0.00	0.00	2039.21	1587.62	1148.43



Livestock reconciliation

Livestock numbers

	January	February	March	April	May	June	July	August	September	October	November	December
Local cows	2	2	2	2	2	2	2	2	2	2	2	2
Local female calves				1	1	1	1	1	1	1	1	1
Local male calves				1	1	1	1	1	1	1	1	1
Female yattle	5	5	5	5	5	5	5	5	5	5	5	5
Young yattle				3	3	3	3	3	3	3	3	3
Sows	1	1	1	1	1	1	1	1	1	1	1	1
Piglets						2	2	2	2	2	2	1
Poultry-eggs	15	15	15	15	15	15	15	15	14	14	14	14



manure reconciliation

Note: The values in red indicate intended organic fertiliser use. If there is insufficient manure on farm to meet this need, the model will scale back usage to the amount available.

	Kilograms											
	January	February	March	April	May	June	July	August	September	October	November	December
Manure opening balance	1359	1420	1480	1540	0	195	399	601	801	1000	1123	1244
Manure production	286	285	284	347	345	354	352	351	349	348	346	340
Manure for fertiliser use (Intended fertiliser use)	0	0	0	1662	0	0	0	0	0	0	0	0
Manure for heating	225	225	225	225	150	150	150	150	150	225	225	225
Manure purchase (for heating only)												
Manure closing balance	1420	1480	1540	0	195	399	601	801	1000	1123	1244	1359



Livestock product reconciliation

		Kilograms												
		January	February	March	April	May	June	July	August	September	October	November	December	Annual total
Local cow milk														
	Production		22.70	37.70	52.60	63.65	74.62	92.95	92.62	73.84	62.54	51.33		624.55
	Own consumption													
	Sales													
	Purchases													
Yattle milk														
	Production			67.03	100.19	116.48	145.09	165.24	164.66	139.47	98.11	81.47		1077.74
	Own consumption													
	Sales													
	Purchases													
Butter														
	Production		1.14	5.24	7.64	9.01	10.99	12.91	12.86	10.67	8.03	6.64		85.11
	Own consumption		9.00	9.00	9.00	12.00	12.00	12.00	12.00	12.00	12.00	9.00		108.00
	Sales							0.91	0.86					1.77
	Purchases		7.86	3.76	1.36	2.99	1.01			1.33	3.97	2.36		24.66
Cheese														
	Production		1.82	8.38	12.22	14.41	17.58	20.65	20.58	17.06	12.85	10.62		136.18
	Own consumption		13.50	13.50	13.50	18.00	18.00	18.00	18.00	18.00	18.00	13.50		162.00
	Sales							2.65	2.58					5.24
	Purchases		11.68	5.12	1.28	3.59	0.42			0.94	5.15	2.88		31.05
Eggs														
	(number)													
	Production	134.44	133.88	133.32	132.76	132.21	131.66	131.11	130.57	130.02	129.48	128.94	128.40	1576.79
	Own consumption	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	720.00
	Sales	74.44	73.88	73.32	72.76	72.21	71.66	71.11	70.57	70.02	69.48	68.94	68.40	856.79

Information sources

- Household surveys in 2009 and 2010
- Interviews with local officials, enterprise managers and local traders
- Technical information from agronomists, animal production scientists and extension officers
- Technical and socio-economic information from previous studies
- Secondary information from regional statistical yearbooks

Specialisation scenarios

Region	Household development strategy	Scenario details
Bailang	<ul style="list-style-type: none"> • Livestock specialization into improved dairy cows • Some shift from food to fodder crops 	<ul style="list-style-type: none"> • Increase in improved milking cows from 4 to 10. • Reduction in other livestock of 26 sheep and goats (which although grazed for much of the year still draw on household feed resources in winter), the local draught bull, and 2 sows. • 4mu of land previously mixed cropped with barley and canola as well as 4mu of single cropped barley is replaced with 8mu of oats.
Mozhugongka	<ul style="list-style-type: none"> • Crop specialization into canola • Modest scaling back of dairy/livestock production to enable off-farm activities 	<ul style="list-style-type: none"> • Barley area reduced from 11 to 5 mu and canola area increased from 3 to 9 mu • Local cows reduced from 3 to 2 and draught local bull dispensed with
Naidong	<ul style="list-style-type: none"> • Scaling up and specialization of dairy production • Shift away from off-farm activities • Reliance on externally sourced feed 	<ul style="list-style-type: none"> • Increase in improved milking cows from 3 to 10. • Reduction in other livestock of 2 sows and 1 egg layer • No change in cropping patterns on own land • 3 mu of low productivity land is rented for vetch production. • Off farm work (total of 125 person days) foregone

Findings – base household models

- >50% value of agricultural outputs are for own consumption
- <20% value of agricultural outputs are sales
- All base models lead to positive net returns to management
 - Rmb3130 to Rmb6640
 - but returns critically dependent on valuation of own labour
- Feasible with household cash flows
 - But farm sales insufficient to meet unexpected or irregular major household expenditures (met from off-farm income)

Findings – base household models (2)

- Large surplus labour in October to March period
 - Limited if any casual labour
 - Livestock labour 20% to 30% of household labour
- Crop production sufficient for own consumption with modest sales
- Dairy production sufficient for own consumption with modest sales
- General deficit in livestock feed
- Manure sufficient for heating but only some organic fertiliser requirements

Findings – Specialisation analysis

- Innovations and specialisation can increase net returns
- ***BUT*** improvements modest
 - Rmb 640 to RMB6900
- ***AND*** dependent on vagaries of external markets (feed prices and product prices)
 - Own consumption now only 27 to 40% of value of outputs while sales are 29 to 50%

Findings – Specialisation analysis (2)

- In Bailang and Naidong,
 - total costs increase three fold with livestock feed costs accounting for 70% of costs
 - Large quantities of straw, cereals, brewers waste and canola meal bought in for livestock feed
 - More pressure to employ casual labour in peak summer periods
 - Butter/cheese making labour accounts for 60% of livestock labour and 18 to 36% of total labour
 - Over two thirds of dairy production has to be sold
- In Mozhugongka
 - Dairy products accounts for only 80% of own consumption
 - 84% of canola to be sold
 - Off-farm income accounts for more than 50% of cash receipts
- In all regions
 - Large quantities of straw and cereals to be brought in for livestock feed
 - Surplus labour still in November to March period

Concluding remarks

In push to modernise and intensify production

- Facilitate transition from semi-subsistent to semi-commercial food and agricultural household systems
- Need to identify innovations and practice changes that increase magnitude of net benefits given scope of changes and risks faced
- Search beyond specialisation and intensification on-farm
 - off-farm income and migration
 - Dysfunctional marketing systems & specialty products