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IMPROVING PROFITABILITY OF SMALL FARM BY SPECIALIZATION IN COW CALF SECTOR IN CHINA'S CENTRAL PLAIN: CASE OF HEBEI PROVINCE

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ABSTRACT

China's beef consumption is increasing with the increase of urban population and its incomes. While beef consumption continues to increase; since 2011, beef production has progressed more slowly because of the decrease in the total number of cattle since 2000. However, most of bovine farms in China are small sizes. Large bovine industries are mainly speculated in the fattening and the slaughter, the calves have supplied by the small farms that are unspecialized. Faces in many constraints several breeders prefer to liquidate even breeding animals and have embarked on other economics activities. Many cattle farms have disappeared and are continuing to disappear: the Cow-calf sector is contracting.

The research aims to analyze and to compare the profitability of small farms by specialization in cow-calf sector.

the analyzes of cost, income, the assessment of profitability of each type of Cow-calf operator by calculation of Break even and Coefficient of economic efficiency and the comparison of different results to present the impact of specialization.

Form the found results: small farm in China's central plain are not profitable, as specialized or no in cow calf operation. Improving their profitability necessitates the decrease in feed price.

Keywords: Profitability, Specialization, Cow-calf sector, Small farm, China

Introduction

Chinese agriculture is mainly based on production of cereals, vegetable and textile fibers [1]. Livestock also plays an important role in agriculture. On the estimate of 350 million farmers, 80 to 100milion farmers are involved in breeding. Animal production in China mainly focused on pork and poultry. China is therefore not a country with a strong tradition of cattle breeding, because the latter have long been used as mere laborers [1]-[2]. In recent decades, the level of meat consumption in China has increased significantly to 57.3 kg/capita in 2009 [3]. Consumption of beef and veal, representing only a small proportion of total meat consumption,

Vol. 2, No. 05; 2017

ISSN: 2456-8643

around 5 kg /capita (8.7% of total meat consumption per capita) in urban areas, is even lower in rural areas [4].

Nevertheless beef is considered as healthy and high-end product, and its demand is expected to increase with the increase in the urban population and its incomes. Simpson estimates that " consumption of beef in China will be 6.5 kg / capita in 2020 and 7.5 kg / capita in 2030" [3].

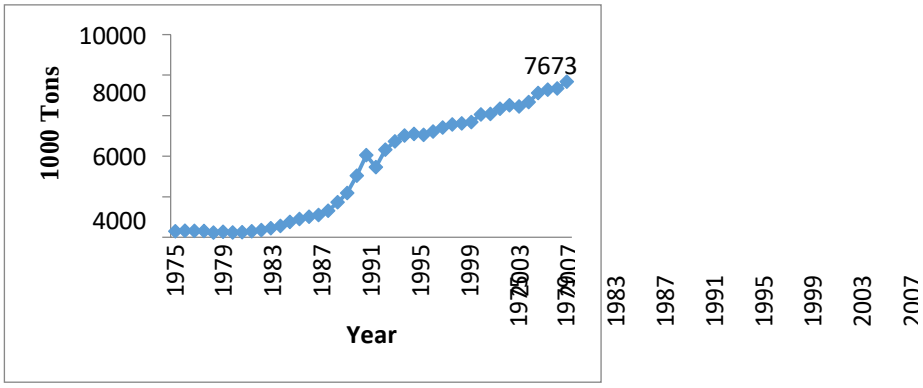


Figure 1: Domestic consumption of beef in China **[5]**

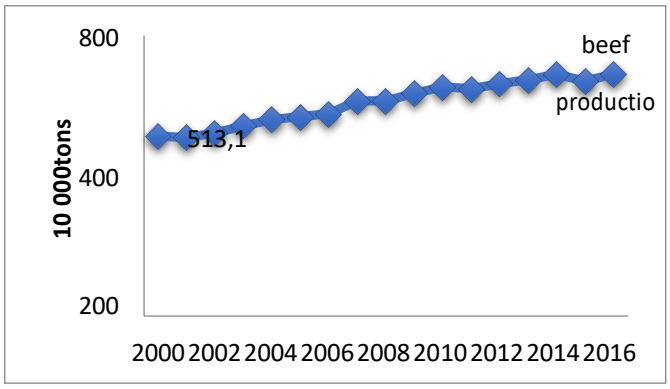


Figure 2: National beef production [5]-[6]

As beef consumption has increased, beef production in China has also increased since 1978, corresponding to the year of Chinese economic reform and opening-up policy. Production increased from 0.28 million tons in 1978 to

6.97 million tons in 2016 [5]-[7].

Vol. 2, No. 05; 2017

ISSN: 2456-8643

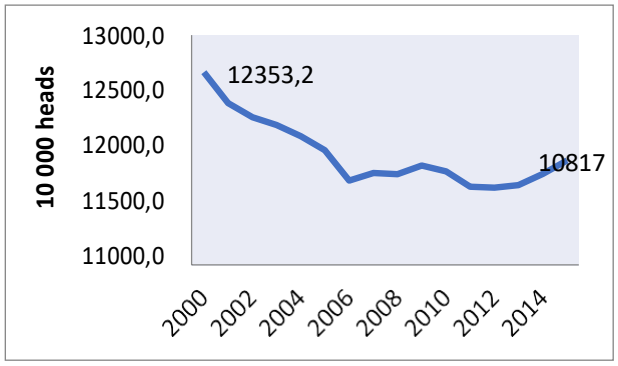


Figure 3: Evolution of cattle in china [6]-[8]-[9].

While beef consumption continues to increase in china; since 2011, beef production has progressed more slowly because of the decrease in the total number of cattle since 2000. however, most of bovine farms in China (11.8 million) are small sizes with fewer than 10 heads [7] - [10]. And facing several constraints including: unavailability of land, lack of long-term projects and technical itineraries integrating new market demands, lack of knowledge and skill on small farms, the delay in bovine genetic breeding, the unstructured practice of the cattle industry, low productivity of natural pastures, higher prices for animal feed, lower public support than in the pig sector, the length of the livestock cycle, the attractiveness of other sectors [2]-[3]-[7]-[11]-[12].

The researchers argue that face in many constraints and because of the increase in domestic demand, several breeders seeing that prices of animals rise have found it better to liquidate even breeding animals and have embarked on other economics activities. Some of them become specialized fattening operations especially in agricultural areas. Many cattle farms have disappeared and are continuing to disappear. And the sector is in difficulty for the renewal of the herd. So the decline in the number of breeding cows subsequently leads to a sharp decrease in overall beef production. As a result, the price of beef increased to 62 CNY/kg in 2016, 4 times the price of meat in 2000 [3]-[4]-[7]-[9]-[10]-[13].

Vol. 2, No. 05; 2017

ISSN: 2456-8643

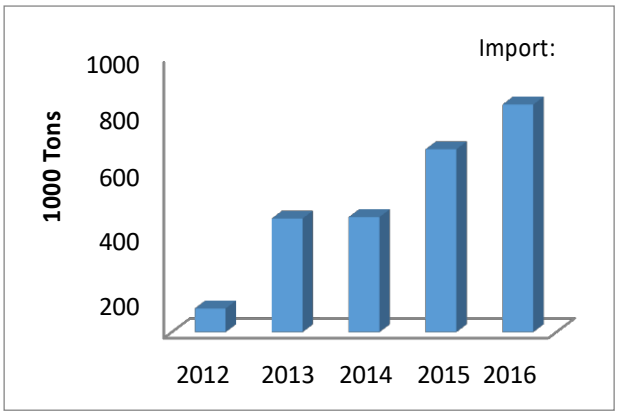


Figure 4: Beef import in China [5].

To compensate for the weakness of production and to respond to the increase in demand, in 2016 China imported mostly frozen boned meat 825 000 tons Carcass weight equivalent (Cwe) [5]. The Netherlands Bank Rabobank estimates that by 2025, an additional 2.2 million tons of beef will be needed to meet the increase in Chinese demand. If China continues to increase its imports, the price of beef on the global market will increase substantially [13].

[12] said "If China maintains its current population, and its per capita beef consumption catches up to the global average, the demand for beef and veal in China will increase by about 3.77 billion tons, which is more than China' s total domestic beef production in 2015".

In response to the surge in imports, the Government of China has developed a plan to revive beef production, which aims to curb the increase in carcass imports by increasing local production, 7.17 million Tons in 2015 and 7.86 million tons in 2020 [12].

As a result of the surge in beef prices on the Chinese market, producer prices have also increased enormously, but paradoxically, instead of motivating farmers to produce more, they prefer to liquidate even breeding animals to embrace other economic sectors. The number of small cattle farms continues to decline. Illustrated by the case of Shandong Province in Central's Plains, where the households that turn off 1-9 heads per year had reduced from 72% in 2005 to 34% in 2013 [10].

If producers prefer to embrace other sectors of activity, while beef market indicators are interesting, there is an issue in which it is imperative to find solutions: beef demand increase, beef price in the market increase, while farms disappear, production also decrease, so increasing

Vol. 2, No. 05; 2017

ISSN: 2456-8643

of import. China must improve local production to meet market demand, knowing that this production is mainly held by small farms.

We note in passing that the large bovine industries in China are mainly speculated in the fattening and the slaughter. The calves have supplied by the small farms (unspecialized Cow-calf operators). Thus the disappearance of small farms leads to the reduction of livestock, which in turn reduces domestic production with all the related consequences, such us: the weakening of the chain of production, rising prices and rising imports. Than Waldron, S. asked about the contraction of the cow- calf sector, especially in central China: "who will produce China's cows and calves in to the future?" [10].

From this question above, we asked:

• How can Cow-calf sector be improved in Chinese central plain?

• Did specialization can be used by small farm to develop the Cow-calf sector?

• Is it profitable for small farms to specialize in Cow- calf sector?

• Who can produce cow and calf in china's central plain? According to our assumptions:

• The Cow calf sector is mostly assure by small scale farms that are unspecialized, than this sector can be improved by specialization such as in Canada and US where it has developed and is the key aspects of beef industry.

• We suppose like all the sectors of beef industry are specialized as feeders, fatteners, slaughters, Cow- calf sector also should be specialized to improve beef industry; that can be more profitable for small farms.

• If Cow-calf production is profitable for small size operator, Cow-calf can be produce by small farms that are many.

Our research aims:

• To analyze and to compare the profitability and sustainability of small farms according the type of cow-calf operations.

• To assess the impact of specialization in the cow- calf sector on profitability.

The choice of beef production in China is justified by the growing demand of beef from the demographic and economic trends in China in recent years, the surge in beef prices on the

Vol. 2, No. 05; 2017

ISSN: 2456-8643

Chinese market, increasing of import, decrease of production, the contraction in cow-calf sector and the decline in number of small cattle farms.

2.Materials and Methods

Research Design

This research employed the mixed approach, using both quantitative and qualitative methods. The analysis, evaluation, comparison and estimation of profitability of specialization of small size farms on cow-calf sector were done using the quantitative methods while the qualitative was utilized to describe small farms according their activities. The research was done during 2016-2017 academic year, considering farm's data from 2016 to 2017.

Data collection

Documentary technique had used to collect secondary data; while primary data had obtained by using survey.

Snowball sampling had used to meet farmers. Data collection had conducted from 17 farms calf producers that have less than 35 heads.

We collected data in Hebei province, Langfang city, Yongqing County, in different towns and villages. This choice was justified by:

- Firstly Hebei is the third largest beef-producer in china with 523 000 tons in 2015 [14].

- Secondly, Hebei is near Beijing, which is China's great consumption center

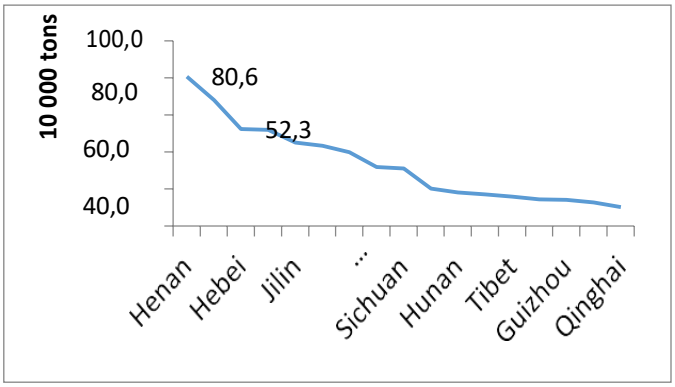


Figure 5: Beef production by Province [6]

Vol. 2, No. 05; 2017

ISSN: 2456-8643

Working hypothesis

• Livestock population remain constant, given the available infrastructure and fixed costs;

• The annual calving rate of cows is 90% (45% for female calf and 45% for male calf);

• Mortality rate of Cow, heifer and calf are respectively 2%, 4% and 8%;

• The cow reform rate is 15% per year;

• Calves are sold at weaning age (3 month old);

• Since the data are not normally distributed on the set, they are distributed in class to allow a good analysis;

• For variables whose distribution is not normal, we considered median values and those that follow a normal distribution the mean values are considered.

Analysis

All analyzes have done related on different type of Commercial Cow-calf operators:

 Those one produce feeder cattle to be raised by other agricultural enterprises, such as feedlots. They sell their calves after they have been weaned and are under a year in age. Here we had two cases, in the first case the mother cattle come from female calves raised on the farm itself and retained into adulthood, the second case cows are purchasing from a specialized seed stock operation which often produces purebred cattle;

 The second are those that raise the calves for 1–2 years before selling them directly to slaughter.

The data collected were been compiled, analyzed using software such as Excel, Spss.

Quantitative data allow descriptive analyzes break-even calculation and coefficient of economic efficiency. The results were been presented in tables; graphs...The qualitative data were been presented in such as summaries and arguments to support the quantitative data.

Since the data are not normally distributed on the set, they are distributed in class to allow a good analysis. For variables whose distribution is not normal, we considered median values and those that follow a normal distribution the mean values are considered.

Vol. 2, No. 05; 2017

ISSN: 2456-8643

•TI: Total income

• TVC: total variable cost

• TFC: total fixed cost

• CEE: Coefficient of economic efficiency

• Cow's reformed rate = 0.15

• Cow's mortality rate = 0.02

• Calf's mortality rate = 0.08

• Calf's Born rate = 0.9

• Number of Cow at the end of the year = (number of cow at the beginning X Cow's reformed rate X Cow's mortality rate) + Heifers bought

• Number of bull remains stable, reformed bull is directly replaced;

• Number of calf = number of cow at the end f the year X Calf's mortality rate X Calf's Born rate

• Number of female calf is the half of calf's of Number

• VCM : Variable Cost Margin

3. Results and discussion

The results were presented in two parts: first, a description of farmers according their activities; and second, results depict analyzed, estimated and compared profitability of specialization of small size farms on cow- calf sector. All data came from survey.

Farms and farmers description

a. Description about Main activities

Vol. 2, No. 05; 2017

ISSN: 2456-8643

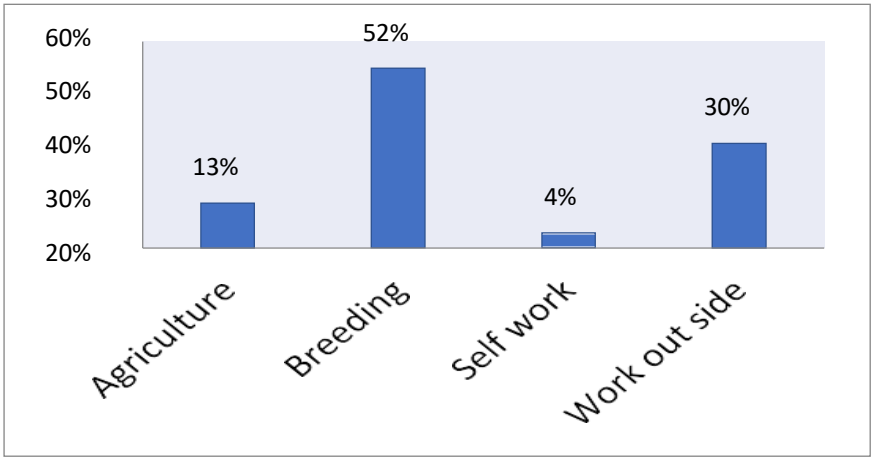


Figure 6: Main activities

Figure 6 show that most of farmers are predominantly breeders with some working outside.

b.Different costs and price

Tableau 1: Fixed cost

Class	*Median*
3 – 12	43586,67
13 - 22	48700
23-32	59866,67

The fixed cost including cost of building depreciation, cost of gasoline, electricity cost, renting of land… This table shows that 50% of the farms have a fixed cost less than 43586,67 CNY, 48700 CNY, 59866,67 CNY respectively for the classes of 3-12, 13-22, 23-32 animals and 50% have a fixed cost Above that amount.

Vol. 2, No. 05; 2017

ISSN: 2456-8643

Tableau 2: Variable cost for unspecialized farms

Class	*Median (CNY)*
3 - 12	65928
13 - 22	174810
23 above	189660

The variable cost of farms is mainly composed by feed cost that is high

Tableau 3 : Cost of forage

Cost of forage used per head (CNY/day)
19,7

It should be noted that in Hebei Province, farms have little or no pasture and as such farmers purchase feed. The high demand for livestock feed and cereal competition with human justifies the high Feed cost, and consequently the increase in variable costs. Huang Y. stated that the use agro food byproduct as feeds for ruminants is very important [3].

Tableau 4 : Medical cost

CLASS	*Average cost (CNY/year)*
3 - 12	100
13 - 22	372,5
23 above	100

Vol. 2, No. 05; 2017

ISSN: 2456-8643

Tableau 5 : Live price of animals

Items	*Average Price CNY/Kg*
Male calf	42
Female calf	65
Heifer	-
Cow	21
Bull	24

The live price of adult cow and bull is almost similar to that presented by Wang ML about 26 CNY/kg in 2015. Thus Live price of male calf is 42 CNY and 65 CNY for female calf; respectively two times and three times the live price of calf at 2013 (20CNY/kg) [4]-[7].

Tableau 6 : Average Weight of animals

	Kg/head
Male calf at weaning age (3month)	117
Female calf at weaning age (3month)	103
Heifer at 2 years	320
Adult Cow	538
Adult Bull	614

Profitability calculation

First case: Unspecialized farms

These are the farms we have surveyed, we can also assimilate to the commercial cow-calf operators that raise calves for 1-2 years and sell to slaughter. We calculated the break even and coefficient of economic efficiency to evaluate the profitability of unspecialized farms

Vol. 2, No. 05; 2017

ISSN: 2456-8643

Tableau 7: Break even of unspecialized farms

Items	*3-12*	*13-22*	*23-32*
total Income	31200	126975	227175
fixed cost	43587	48700	59866,6
variable cost	65928	174810	189660
VCM	-34728	-47835	37515
Break even	-39158,7	-129271	362527,3

As Variable Cost Margin is negative for farms with 3-12 and 13-22 heads, these farms are not profitable. Farms with 23-32 animals become profitable when Income greater than 362527, 3 CNY. This results opposite to fatten gross margin, that was about 1 550 CNY/head [7].

Tableau 8: Coefficient of economic efficiency of unspecialized farms

Items	*3-12*	*13-22*	*23-32*
total Income	31200	126975	227175
fixed cost	43587	48700	59866,6
variable cost	65928	174810	189660
CEE	0,284893	0,568095	0,910424

Economically all these farms are not efficiencies, because the coefficient of economic efficiency is less than 1, as well the farms of 23-32 animals have a CEE close to 1.

Second case: Farms those cows are purchased from a specialized seed stock and sell all calves

Vol. 2, No. 05; 2017

ISSN: 2456-8643

Considering the median number of animals in each class, and assuming that the farmer does not increase the value of the investments, therefore the number remains stable, the mating is ensured by a bull and cows are purchased from a specialized Seed stock and sell all calves.

The herd is as follows:

Tableau 9: Herd presentation at the end of the year for farms those cows are purchased from a specialized seed stock and sell all calves

ITEM	*CLASS*			
	3-12	*13-22*	*23-32*	*32*
Median of class	**8**	**18**	**28**	
Cows	7	17	27	31
Bull	1	1	1	1
Birth				
Males calves	3	6	10	11
Female calves	3	6	10	11
Purchase				
Heifers	1	3	4	5
Animals sold				
Male calves	3	6	10	11
Female calves	3	6	10	11
Reformed Cow	1	3	4	5
Total animal	**8**	**18**	**28**	**32**

Vol. 2, No. 05; 2017

ISSN: 2456-8643

Tableau 10: Income calculation of farms those cows are purchased from a specialized seed stock and sell all calves

ANIMAL SOLD	*3-12*	*13-22*	*23+*	*32*
Number of male calves	3	6	10	11
Live price of males calves (CNY/Kg)	42	42	42	42
Weight of males calves (kg)	117	117	117	117
Number of female calves	3	6	10	11
Live price	65	65	65	65
of females calves (CNY/Kg)				
Weight of females calves(kg)	103	103	103	103
Number of reformed Cow	1	3	4	5
Live price of Cow (CNY/Kg)	21	21	21	21
Weight of Cow (kg)	538	538	538	538
TOTAL INCOME	41930, 2	101830, 5	161730, 8	185690, 9

Vol. 2, No. 05; 2017

ISSN: 2456-8643

Tableau 11: Break even calculation of farms those cows are purchased from a specialized seed stock and sell all calves

Items	*3-12*	*13-22*	*23-32*	*32*
total Income	41930,21	101830,5	161730,8	185690,9
fixed cost	225763	470076	720442	816122
variable cost	65979,03	155419,7	233660,5	267196,8
VCM	-24048,8	-53589,1	-71929,7	-81505,9
Break even	-393628	-893242	-1619882	-1859331

Tableau 12: Coefficient of economic efficiency calculation of Farms those cows are purchased from a specialized seed stock and sell all calves

Items	*3-12*	*13-22*	*23-32*	*32*
total Income	41930,21	101830,5	161730,8	185690,9
fixed cost	225763	470076	720442	816122
variable cost	65979,03	155419,7	233660,5	267196,8
CEE	0,143724	0,1628	0,169511	0,171409

In this case, the Variable Cost Margin is negative; the breeding is not profitable for all farms with fewer than 32 animals. Specialization of small farms in cow-calf operators is not profitable and economically inefficient.

Third case: Cow from female calves raised on the farm itself and retained into adulthood

Although, this case is similar to the previous, the difference lies in the fact that Cows come from female calves raised on the farm itself and retained into adulthood. The cow replacement is done at the annual cow reform rate of 15%. Thus the herd is presented as follows:

Vol. 2, No. 05; 2017

ISSN: 2456-8643

Tableau 13: Herd at the end of the year for Cow from female calves raised on the farm itself and retained into adulthood

ITEM	*CLASS*			
	3-12	*13-22*	*23-32*	*32*
Median of class	**8**	**18**	**28**	
Cows	7	17	27	31
Bull	1	1	1	1
Birth				
Males calves	3	6	10	11
Female calves	3	6	10	11
Transfer from calf to heifer				
Heifers	1	3	4	5
Animals sold				
Male calves	3	6	10	11
Female calves	2	4	6	7
Reformed Cow	1	3	4	5
Total animal in herd	**8**	**18**	**28**	**32**

Tableau 14: Income calculation of Cow from female calves raised on the farm itself and retained into adulthood

Cow	*3-12*	*13-22*	*23-32*	*32*
TOTAL INCOME	34900,46	84758,26	134616,1	154559,2
ANIMALS SOLD				
Number of male calves	3	6	10	11
Live price of males calves CNY/Kg	42	42	42	42
Weight of males calves	117	117	117	117
Number of female calves	2	4	6	7

Live price of females calves	65	65	65	65
Weight of females calves	103	103	103	103
Number of reformed Cow	1	3	4	5
Live price of Cow	21	21	21	21
Weight of	538	538	538	538

Tableau 15: Break even of Cow from female calves raised on the farm itself and retained into adulthood

Items	*3-12*	*13-22*	*23-32*	*32*
total Income	34900,46	84758,26	134616,1	154559,2
fixed cost	203923	417036	636202	719402
variable cost	65979,03	155419,7	233660,5	267196,8
VCM	-31078,6	-70661,4	-99044,5	-112638
Break even	-229000	-500234	-864693	-987149

Tableau 16: Coefficient of economic efficiency of Cow from female calves raised on the farm itself and retained into adulthood

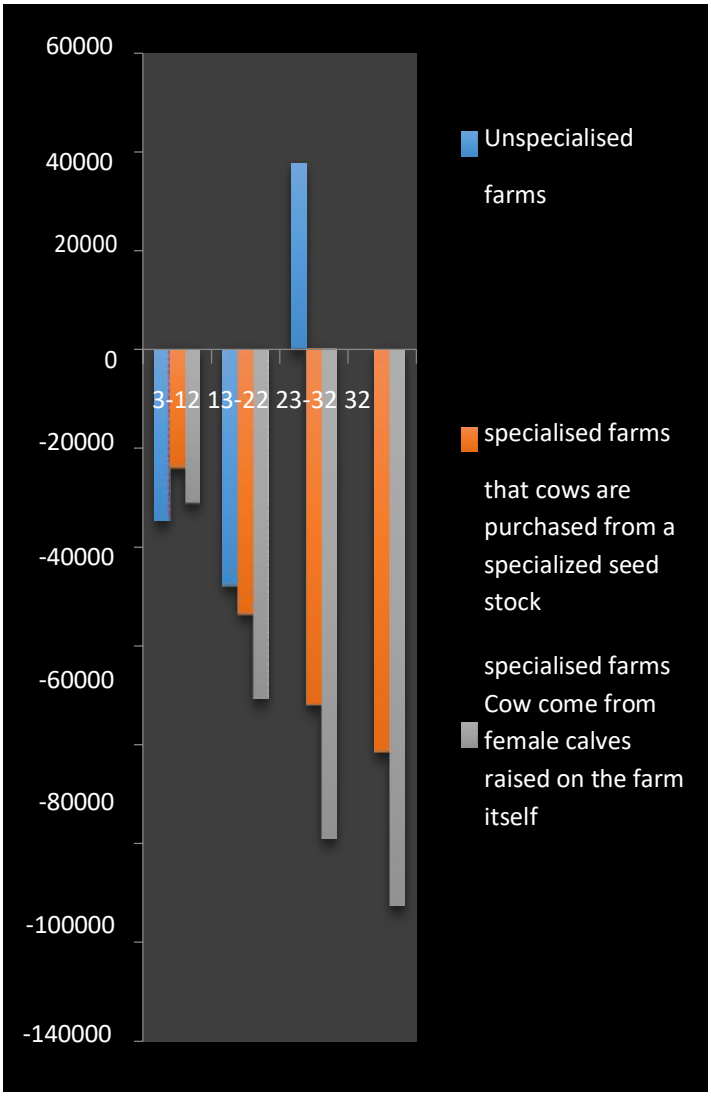
Items	*3-12*	*13-22*	*23-32*	*32*
total Income	34900,46	84758,26	134616,1	154559,2
fixed cost	203923	417036	636202	719402
variabl e cost	65979,03	155419,7	233660,5	267196,8
CEE	0,129308	0,148061	0,154756	0,156659

Vol. 2, No. 05; 2017

ISSN: 2456-8643

This case does not differ from the previous, all operating results are negative, and so exploitation is not profitable for all farms with fewer than 32 animals. Specialization of small farms in cow-calf operators is not profitable and economically inefficient.

Assessment of the impact of specialization in the cow-calf sector on profitability



Vol. 2, No. 05; 2017

ISSN: 2456-8643

Figure 7: Comparison of VCM of different type of commercial Cow-calf operation

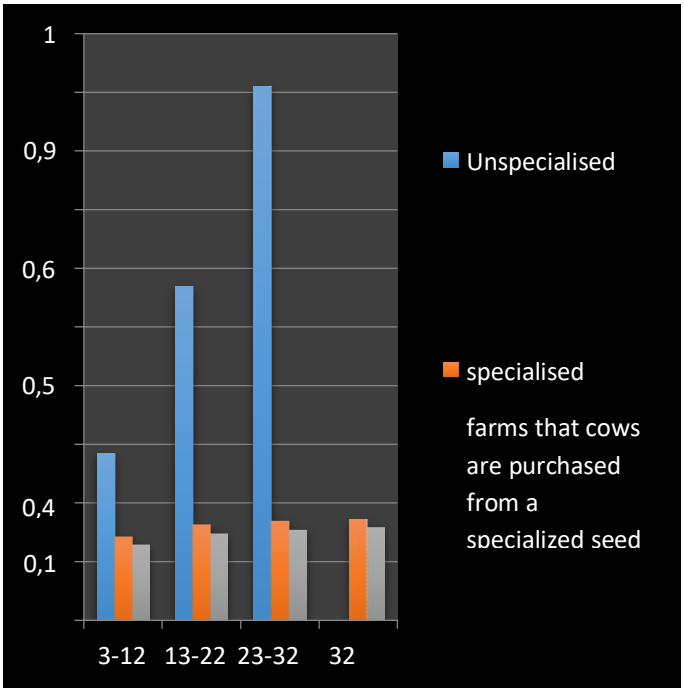


Figure 8: Comparison of CEE of different type of commercial Cow-calf operation

Comparison of Variable cost margin and Coefficient of economic efficiency of different types of Cow calf enterprise showed that specialization has a negative impact on profitability in the cow calf sector, as larger livestock size implied lesser is profitable of farm

Discussion

Analyzes focused on three types of commercial Cow-calf enterprise:

• The first case is those operators that raise calves for 1-2 years and sell directly to slaughter, this type of Cow-calf operators are assimilated to unspecialized farms.

• The second type is the specialized Cow-calf operator which Cow and Bull come from seed stock or pure bred and all calves are sold to feedlots.

• The third type is the specialized Cow calf operators which Cow come from female calves raised on the farm itself and retained into adulthood.

Vol. 2, No. 05; 2017

ISSN: 2456-8643

From these types of Cow-calf operators, we have analyzed different cost, income, we have also assessed the profitability of each type of Cow-calf operator by calculation of Break even and Coefficient of economic efficiency; and we compared results of different types of enterprise to present the impact of specialization.

Form the calculation of Breakeven:

The unspecialized farms started to became profitable when Income greater than 362527, 3 CNY for those one that have 23-32 heads. But for farms with 3-12 and 13-22 heads, Variable cost margin was negative and wasn't profitable.

Scenario of both specialized Cow calf had a negative results even for farms with 32 heads. In this case, the specialization of farms in cow-calf operators is not profitable.

Relative to Coefficient of economic efficiency: all these farms are not efficiencies, because the coefficient of economic efficiency is less than 1, as well the unspecialized farms with 23-32 heads have a positive Break even and CEE close to 1 is not efficient.

All these results join the conclusion of many researchers who found that small farms in China are not profitable; Such as Longworth (2001) and Waldron demonstrated "that unspecialized cow–calf production decreased net returns because revenues were lower than costs (especially feed and labor)" [10].

Many researchers such as [2]-[3]-[4]-[7]-[9]-[10]-[11]- [12]-[13]; argue that face in many constraints and because of the increase in domestic demand, several breeders seeing that prices of animals rise have found it better to liquidate even breeding animals and have embarked on other economics activities. Some of them become specialized fattening operations especially in agricultural areas or slaughter; because both sectors (fattening and slaughter) are far more profitable than cow calf sector:

around 1500CNY/head of gross margin [7]. Justified the disappearance of Cow calf farms and leads the sector in difficulty for the renewal of the herd. So the decline in the number of breeding cows subsequently leads to a sharp decrease in overall beef production [10].

At the end Comparison of Variable cost margin and Coefficient of economic efficiency of different types of Cow calf enterprise showed that specialization has a negative impact on profitability in the Cow calf sector, as larger is livestock's size as less is farm's profitability.

Vol. 2, No. 05; 2017

ISSN: 2456-8643

Conclusion

Entitled "improving profitability of small farm by specialization in cow calf sector in China's central plain: case of Hebei province", our research responded to the following questions:

• How can Cow-calf sector be improved in China's central plain?

• Can specialization be used by small farm to develop the Cow-calf sector?

• Is it profitable for small farms to specialize in Cow- calf sector?

• Who can produce cow and calf in china's central plain?

According to our assumptions:

• The Cow calf sector is mostly assure by small scale farms that are unspecialized, than this sector can be improved by specialization such as in Canada and US where it has developed and is the key aspects of beef industry.

• We suppose like all the sectors of beef industry are specialized as feeders, fatteners, slaughters, Cow-calf sector also should be specialized to improve beef industry; that can be more profitable for small farms.

• If Cow-calf production is profitable for small size operator, Cow-calf can be produce by small farms that are many.

Analyzes focused on three types of commercial Cow-calf enterprise:

• The first case is those operators that raise calves for 1-2 years and sell directly to slaughter, this type of Cow-calf operators are assimilated to unspecialized farms.

• The second type is the specialized Cow-calf operator which Cow and Bull come from seed stock or pure bred and all calves are sold to feedlots.

• The third type is the specialized Cow calf operators which Cow come from female calves raised on the farm itself and retained into adulthood.

From these types of Cow-calf operators, we have analyzed different cost, income, we have also assessed the profitability of each type of Cow-calf operator by calculation of Break even and Coefficient of economic efficiency; and we compared results of different types of enterprise to present the impact of specialization.

Vol. 2, No. 05; 2017

ISSN: 2456-8643

Form the found results we can conclude that in general, small farm in China's central plain are not profitable, as specialized or no in cow calf operation. Improving their profitability necessitates the decrease in feed price.

Cow calf operation is the key scenario for China`s cattle industry, because the shortage of calves available to finishing feedlots is the biggest limitation to the development of the industry. So, the government needs to take action and conduct more research into improving the production efficiency of beef cows and calves, and implement incentives to make calf production more efficient.

The number of breeding cows is declining but beef production is increasing. The researchers argue that several breeders seeing that prices of animals rise have found it better to liquidate even breeding animals and have embarked on other economic activities. Thus an increase in the production of the meat is observed while the number of animals decreases. Many cattle farms have disappeared and are continuing to disappear, the total number of cattle is declining: from 126.9 million head in 1999 to 103.6 million head in 2011 [3]-[4]-[9]-[13].

Chinese government, through its bovine livestock recovery plan, aims to increase local production to 7.17 million tons by 2015 and 7.86 million tons by 2020 [11]. This target was not reached in 2015, as China produced only 6.70 million tons. China has to increase its efforts to achieve it by 2020. In the meantime, demand for beef is increasing, prices on the market and imports are also increasing.

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Vol. 2, No. 05; 2017

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