

MINISTRY OF EDUCATION  
AND TRAINING

MINISTRY OF AGRICULTURE AND  
RURAL DEVELOPMENT

**NATIONAL INSTITUTE OF ANIMAL SCIENCE**



**DUONG THANH TUNG**

**DETERMINATION OF THE CROSSBREEDING BETWEEN VCN-15 CHICKEN  
WITH SOME COLORED CHICKEN BREEDS FOR FARMING HOUSEHOLDS**

Speciality : Animal Husbandry

Code : 9 62 01 05

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1. National library
2. National Institute of Animal Science library

## **PUBLISHED SCIENTIFIC WORKS RELATED TO THE THESIS**

1. Duong Thanh Tung, Pham Cong Thieu, Nguyen Huy Dat, Nguyen Thi Muoi và Le Thi Thuy Ha. 2019. Some characteristic appearance and production capacity of 2 crossbred hens between VCN-Z15 and LV<sub>1</sub> chickens. Livestock Science Journal, National Institute of Animal Science. Number 103, 9/2019, page 44-54.

2. Duong Thanh Tung, Pham Cong Thieu, Nguyen Huy Dat, Nguyen Van Dai. 2019. Some appearance characteristics, production ability of crossbred chicken Ri chicken x F1 chicken (VCN-Z15 x LV) and Lac Thuy chicken x F1 (VCN- Z15 x LV) raised in Thai Nguyen. Livestock Science Journal, National Institute of Animal Science. Number 104, 10/2019, page 18-30.

3. Duong Thanh Tung, Pham Cong Thieu, Nguyen Huy Dat, Nguyen Van Dai. 2019. Production and meat quality of và crossbred chicken Ri chicken x F1 chicken (VCN-Z15 x LV) and Lac Thuy chicken x F1 (VCN- Z15 x LV) raised in Thai Nguyen. Livestock Science Journal, National Institute of Animal Science. Number 105, 11/2019, page 02-12.

# INTRODUCTION

## 1. THE NECESSARY OF THE STUDY

Vietnam is one of the countries with a large number of poultry in the world. According to Ministry of Agriculture and Rural Development, in 2020 the number of poultry is 496 million heads (in which, chickens 396 million).

Vietnam has many local chicken breeds with high quality of meat and egg. The indigenous chicken breeds are very famous for beautiful appearance, high vitality, medium stature and especially the quality of delicious meat and eggs which are popular with consumers. However, native chicken breeds are often low production. In recent years, Vietnam has imported a number of high production colored chicken breeds, combining pure breeding with selective cross-breeding to create new hybrid combinations for production and supply of high production and quality chicken breeds which meets the chicken breed demand and consumer trends.

VCN-Z15 chicken was imported into Vietnam in August 2007. This is a chicken breed of medium body size, slow growth rate, beautiful appearance, high vitality, high egg yield. Luong Phuong chicken (LV) originated from China, was imported to Vietnam in 2000. Luong Phuong Chicken has diverse feather colors, high resistance, good growth rate and is popularly raised in many provinces. VCN-Z15 and Luong Phuong chicken breeds are valuable genetic resources for breeding work, creating high-quality and productive hybrid chickens. Ri and Lac Thuy chickens have small body size and good appearance, high adaptation with good quality of meat and eggs, suitable for consumers' taste.

The crossing between VCN-Z15 and LV<sub>1</sub> chickens aims to promote genetics of high egg productivity of VCN-Z15 chickens and fast growth ability of LV<sub>1</sub> chickens to create F1 hybrid hens with high egg yield and low feed consumption per 10 eggs. F1 hybrid hens are used as a crossbreeding hen with Ri chicken, Lac Thuy chicken to create a hybrid combination of 3 breeds with higher meat yield, delicious meat quality, suitable for consumers' tastes. This crossing is extremely necessary, especially in the prevailing trend of organic farming and biosecurity.

Therefore, we have carried out the study: "Determination of the crossbreeding between VCN-Z15 chicken with some colored chicken breeds for farming households" in order to promote the advantages and overcome the disadvantages of some chicken breeds such as colored feathers above.

## 2. OBJECTIVE

### 2.1. General Objective

To identify some typical appearance characteristics and production ability of crossbreeding chicken between VCN-Z15 chickens and some colored chicken breeds to create two crossbred hens for breeding and three crossbred chickens for meat for farming households.

### 2.2. Detail Objective

- Determination of some appearance characteristics and production ability of 2 crossbred hens between VCN-Z15 and LV<sub>1</sub> chickens (ZL and LZ).
- Determination of some appearance characteristics, production ability and meat quality of Ri 3 crossbred chicken RZL (Ri x (VCN-Z15 x LV<sub>1</sub>), Lac Thuy 3 hybrid chicken LTZL (Lac Thuy x (VCN- Z15 x LV<sub>1</sub>).
- Evaluation of the production ability of two hybrid hens ZL and commercial 3 hybrid chicken RZL and LTZL chicken raised in households.

### **3. SCIENTIFIC AND PRACTICAL VALUE OF THE STUDY**

#### **3.1. SCIENTIFIC VALUE OF THE STUDY**

- Effectively exploiting genetic resources of VCN-Z15 chickens, LV<sub>1</sub> chickens and some Vietnamese native chickens (Ri, Lac Thuy), creating new hybrid chickens (ZL and RZL, LTZL) with high yield and quality delivered to households and contribute to protecting biodiversity and developing a sustainable ecological agriculture.

- The results of the thesis are valuable scientific documents for scientific research, teaching and livestock development.

#### **3.2. PRACTICAL VALUE OF THE STUDY**

Using genetic resources of VCN-Z15 colored chicken crossed with LV<sub>1</sub> chickens to create two hybrid hens with medium weight, low feed consumption, high egg yield, and more income for farmers. The three hybrid chicken RZL and LTZL chicken have promoted the productivity advantages of foreign chicken breeds and high meat quality of local chicken breeds, creating products that meet the needs of Vietnamese people and contributing to promoting development of the effective and sustainable color broiler raising.

#### **4. NEW CONTRIBUTIONS OF THE STUDY**

- The thesis is a systematic study on appearance characteristics, production ability of two hybrid chickens ZL, LZ and three hybrid chickens RZL, LTZL.

- Research results have determined that two hybrid chickens ZL and three hybrid chickens (RZL and LTZL) with high egg productivity and meat quality to meet production needs and tastes of consumers, and contribute to conservation, exploitation and sustainable and effective development of the genetic resources of viet nameese indigenous chickens.

## **CHAPTER 1 OVERVIEW DOCUMENTS**

### **1.1. SCIENTIFIC BASIS OF RESEARCH PROBLEM**

#### **1.1.1. The scientific basis of hybridization and hybrid superiority**

In poultry breeding, economic hybridization is the most common method. Economic hybridization is a method of crossing 2, 3 and 4 different lines or breeds to create commercial hybrids, not used as breeding chicken. Therefore, it is possible to use the economic hybrid method for mass production in a short time, creating many hybrid breeds with high heterosis and good quality.

#### **1.1.2. Genetic nature of production traits**

- Growth ability: growth is determined by the increase in body weight and zise over certain periods, in fact, the increase in the amount of protein and minerals. To evaluate the characteristics of growth ability, the following criteria are used: body weight, absolute growth rate, relative growth rate and hair growth rate.

- Reproductive ability: expressed through quantitative traits such as laying age, egg yield, laying rate, fertility and hatchability. Different breeds of poultry have different reproductive capacity.

- Feed consumption: Feed consumption for a unit of product is an important economic target in poultry production. Feed cost usually accounts for about 70% of product cost. For breeding chicken, it is common to calculate the cost of feed/10 eggs, for meat-raising poultry to calculate the cost of feed/1kg to increase the body weight.

## **1.2. RESEARCHS IN THE WORLD AND IN THE COUNTRY**

### **1.2.1. Research situation in the world**

Some countries in the world have researched to create commercial eggs and meat between indigenous chicken breeds and imported chicken breeds to create hybrids with high yield and quality. Famous poultry companies in the world have built a complete breeding system (pure, grand parent, parent and commercial chickens). In particular, the heterosis between lines and breeds has been thoroughly used to create commercial crossbreeds with high quality and productive color feathered chicken such as Sasso chicken (France), Kabir chicken (Israel), Luong Phuong chicken, Tam Hoang chicken (China)...

### **1.2.2. Researches in Vietnam**

In Vietnam, there have been many researches on creating commercial crossbreeds for meat production between indigenous chicken breeds and imported high production breeds of Ho Xuan Tung (2008), Nguyen Huy Tuan (2013) between Ri and Luong Phuong chicken; Phung Van Canh (2014) between fighting cocks and Luong Phuong chickens; Nguyen Khac Thinh et al. (2017) between fighting cocks, Dong Tao chicken with TP chicken; Pham Thuy Linh et al. (2019) between Ri chicken and TN3 chicken. In general, commercial crossbreeds for meat production have significantly higher meat production than native chicken breeds with delicious meat quality which is suitable to consumer trends.

## **CHAPTER 2**

### **RESEARCH SUBJECTS, CONTENTS AND METHODS**

#### **2.1. SUBJECTS, LOCATION AND TIME OF STUDY**

##### **2.1.1. Research subjects**

VCN-Z15 chicken, LV<sub>1</sub> chicken, Chicken Ri and Lac Thuy chicken; F1 ZL and LZ hybrid hens; three hybrid chicken RZL and LTZL.

##### **2.1.2. Research location**

Livestock Experimentation and Conservation Center and Mountainous Animal Research and Development Center - Institute of Animal Science; Institute of Life Sciences - Thai Nguyen University of Agriculture and Forestry; Department of Analysis, Faculty of Livestock - Vietnam Academy of Agriculture; Bac Giang, Thanh Hoa and Quang Ninh provinces.

**2.1.3. Study period:** From Feb. 2015 to Feb. 2019.

#### **2.2. RESEARCH CONTENTS**

2.2.1. Study on some appearance characteristics and production capacity of two hybrid chicken VCN-Z15 x LV<sub>1</sub> (ZL and LZ).

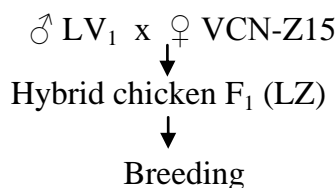
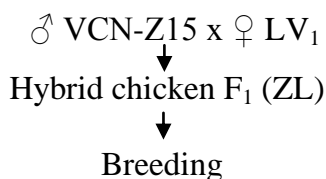
2.2.2. Study on some appearance characteristics, yield and meat quality of three hybrid chicken RZL and LTZL.

2.2.3. Evaluation of the production capacity of two hybrid hens and 3 hybrid chickens RZL and LTZL raised in households.

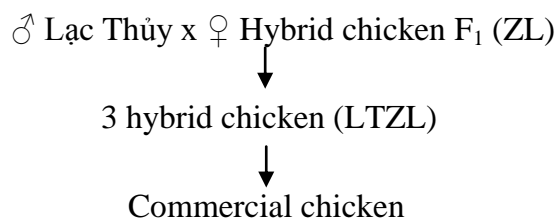
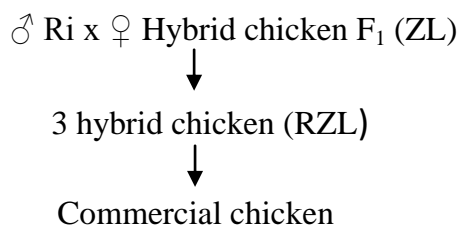
#### **2.3. RESEARCH METHODS**

##### **2.3.1. Hybrid formula**

**Diagram 1: (2 hybrid chicken)**



**Diagram 2: (3 hybrid chicken)**



**2.3.2 Experimental design**

**2.3.2.1. Experiment 1:** *Determination of some appearance characteristics and production capacity of 2 hybrid hens (VCN-Z15 x LV<sub>1</sub>).*

**Table 2.1. Diagram of breeding chicken experiment**

Items	Group 1	Group 2	Group 3	Group 4
	ZL chicken	LZ chicken	VCN-Z15 chicken	LV <sub>1</sub> chicken
<b>1. Chick and chicken gilts stage (01 day old-20 weeks)</b>				
- Hen number/a repetition (chicken)	80	80	80	80
- Repetition number (time)	3	3	3	3
- Total experiment chicken (chicken)	240	240	240	240
<b>2. Laying stage (21-72 week)</b>				
- Hen number/a repetition (chicken)	50	50	50	50
- Repetition number (time)	3	3	3	3
- Total experiment hen (chicken)	150	150	150	150

The experiment was carryout at Livestock Experimentation and Conservation Center – Institute of Animal Science from Feb. 2015 to July 2016.

**2.3.2.2. Experiment 2:** *Determination of some appearance characteristics, production capacity and meat quality of 3 hybrid chicken RZL and LTZL.*

**Table 2.4. Diagram of commercial chicken experiment**

Items	Group 1	Group 2	Group 3	Group 4
	RZL chicken	LTZL chicken	Ri chicken	Lac Thuy chicken
Experiment time (week)	16	16	16	16
Repetition number (time)	4	4	4	4
Chicken number/a repetition (chicken)	50	50	50	50
Total experiment chicken (chicken)	200	200	200	200

The experiment was carried out at the Mountainous Animal Research and Development Center (Thai Nguyen) – Institute of Animal Science from September 2016 to January 2017.

### **2.3.2.3. Determination of production capacity of 2 hybrid hen ZL and 3 hybrid hen RZL and LTZL raising in households**

- 1.500 laying hens per a household in 3 provinces (Bac Giang, Thanh Hoa, Quang Ninh). Households in Bac Giang used Ri chicken cock. Households in Quang Ninh used Lac Thuy chicken cock. The ratio cock per hen is 1:10. Hens were fed by commercial feed. Experiment diet was used diet of breeding chicken from 1-20 week of age (limitation of quantity feed from 1-20 week of age). The experiment was done from July 2017 to Jan.2019.

- 3 hybrid chicken RZL and LTZL raising in households: 2 households in Yen The – Bac Giang were selected to raise 500 RZL and 500 LTZL chicken. Chickens were raised according to the LV<sub>1</sub> broiler farming process of Livestock Experimentation and Conservation Center – Institute of Animal Science. Chicken was raised to 16 week of age for slaughter. The study was carried out from Apr. 2017 to Aug. 2017.

### **2.3.3. Research contents and methods of determination**

The method of study was implemented according to the methods of Bui Huu Doan et al. (2011).

#### **2.3.3.1. Determination of appearance characteristics of chicken**

Direct observation of each individual at 01 day of age, 20 weeks of age for breeding chickens and 16 weeks of age for broiler chickens. The coat color; skin color, foot skin; crest type are observed and described.

#### **2.3.3.2. Research contents of breeding hen**

Survival rate, body weight of chicks, gilts, age of sexual maturity and weight of hens, laying rate, egg yield, feed consumption per 10 eggs, egg weight, egg quality parameters (shape index, eggshell thickness, Haugh unit,..), breed egg rate, chickens grate 1/total hatching eggs, hatching rate/total eggs with embryos, feed consumption, heterosis.

#### **2.3.3.3. Research contents of commercial chicken**

- Survival rate, cumulative growth, absolute growth, relative growth, ability to obtain food, feed consumption per a kg of weight gain, cost of 1 kg of weight gain ; production index, economic index, meat production capacity: live mass; weight and carcass rate, thigh meat rate, breast meat rate, belly fat rate.

- Determination of some criteria on meat quality at Faculty of Animal Husbandry, Vietnam Academy of Agriculture.

- Determination of some criteria on chemical composition of chicken: determined in left thigh and breast meat which was analyzed at the Department of Chemical Analysis, Institute of Life Sciences, Thai Nguyen University of Agriculture and Forestry

### **2.3.4. Data analysis methods**

Data was collected and analyzed by excel 2010 and SAS 9.0 software of Marasighe M.G và Kennedy W.J, (2008). The results are presented in tables using statistical parameters such as sample size (n), mean (Mean), standard error (SE), standard deviation (SD) and coefficient of variation. (CV %). When comparing ratios or studying the relationship between factors for qualitative variables, the c2 (Chi-Square) test is used. The data was analyzed for variance according to the statistical model:

$$y_{ij} = \mu + S_i + e_{ij}$$

$y_{ij}$  = Parameters of chicken j of group i;  $\mu$  = mean;  $S_i$  = affect of group i (i= breed);  $e_{ij}$  = random error



**CHAPTER 3**  
**RESULTS AND DISCUSSION**

**3.1. SOME APPEARANCE CHARACTERISTICS AND PRODUCTION CAPACITY OF TWO HYBRID CHICKEN VCN-Z15 x LV<sub>1</sub>.**

**3.1.1. Chararotistics of 2 hybrid chicken ZL and LZ**

**Charateristics of one day old chick**

Chicken LV<sub>1</sub> at 01 day old has 3 main color groups: yellow feathers with 2 brown stripes on the back, brown spots on the head; gray feathers with brown spots on the tips and yellow feathers with 2 faint stripes, pinkish-white legs, uniform yellow beak. VCN-Z15 chicken at 01 day old has fluffy feathers, yellow-brown feathers with dark brown-brown stripes on the back, black-brown spots on the head; Legs and beak are pinkish white.

**Charateristics of twenty-week old chicken**

Chicken LV<sub>1</sub> at 20 weeks of age has a variety of feather colors such as pure yellow, yellow flower spots, black flower spots. The crest is bright red and erect with 7-8 pointed combs. The wattle is red. The hen has a small head, strong body, rectangular shape, yellow beak, yellow legs, and yellow skin. Chicken VCN-Z15 at 20 weeks of age has uniform color feather. Hens have brown feathers, yellow neck with black spots; Wedge-shaped body, large red crest, white ears, large red wattle, yellow legs and skin.

**3.1.2. Production capacity of two hybrid chicken ZL and LZ**

**3.1.2.1. The survival rate of two hybrid chicken ZL and LZ from 1-20 weeks of age**

The results in table 3.1 show that chickens form 1-20 weeks of age, the survival rate is quite high. The survival rate of ZL and LZ chicken are 97,5%. 20 weeks of age, the survival rate is 92,92-95%. The survival rate of ZL chicken is highest (95%). LZ chicken is 94,58%. LV<sub>1</sub> chicken is lowest (92,92%). Hybrid advantage of survival rate is 1,56% with ZL chicken and 1,11% with LZ chicken.

**Table 3.1. The survival rate of experiment chicken at chick and gilt stage (Unit: %; n=3)**

Week of age	Group 1 ZL chicken	Group 2 LZ chicken	Group 3 VCN-Z15 chicken	Group 4 LV <sub>1</sub> chicken
1	99,17	99,17	99,17	99,17
<b>6</b>	<b>97,50</b>	<b>97,50</b>	<b>97,08</b>	<b>97,50</b>
12	95,83	96,25	96,25	95,83
18	95,42	95,00	94,58	93,33
<b>20</b>	<b>95,00</b>	<b>94,58</b>	<b>94,17</b>	<b>92,92</b>
<b>H (%)</b>	<b>1,56</b>	<b>1,11</b>		

**3.1.2.2. Body weight of ZL hen and LZ hen at chick and gilt stage**

The results in table 3.2 show that at one day old chick, LV<sub>1</sub> hen has highest body weight (34.86g), VCN-Z15 hen has lowest body weight (34.12g). ZL and LZ hen have body weight are 34.17 g and 34.31 g respectively. However, there was no different in body weight between experimental groups with P>0.05.

At the end of chick stage (1day old to 6 weeks of age), LV<sub>1</sub> chicken has highest body weight (975.83g), VCN-Z15 chicken has lowest body weight (550.89g); ZL chicken and LZ

chicken have body weight are 829.83g and 839.17g respectively. The different between experimental groups is significant.  $P < 0.05$ .

The coefficient of variation (CV) in crossbred chickens is quite low, in ZL chicken is 7.64% and LZ chicken is 6.19% which shows that crossbred chicken has high uniformity.

**Table 3.2. The body weight of hens from 1 day old to 20 weeks of age (unit: g/con; n= 90)**

Week of age	Group 1 ZL chicken		Group 2 LZ chicken		Group 3 VCN-Z15 chicken		Group 4 LV <sub>1</sub> chicken	
	Mean ± SD	CV%	Mean ± SD	CV%	Mean ± SD	CV%	Mean ± SD	CV%
1NT	34,17 <sup>a</sup> ± 1,33	3,88	34,31 <sup>a</sup> ± 1,55	4,51	34,12 <sup>a</sup> ± 1,48	4,32	34,86 <sup>a</sup> ± 1,40	4,02
6	829,61 <sup>c</sup> ± 63,39	7,64	839,17 <sup>b</sup> ± 58,72	6,19	550,89 <sup>d</sup> ± 42,88	7,78	975,83 <sup>a</sup> ± 87,10	8,93
12	1.369,67 <sup>c</sup> ± 132,00	9,64	1.433,00 <sup>b</sup> ± 119,70	8,35	966,33 <sup>d</sup> ± 77,58	8,03	1.579,44 <sup>a</sup> ± 124,0	7,86
18	1.728,22 <sup>c</sup> ± 147,08	8,51	1.812,44 <sup>b</sup> ± 140,65	7,76	1.276,33 <sup>d</sup> ± 100,04	7,84	1.962,56 <sup>a</sup> ± 184,9	9,43
20	1.825,56 <sup>c</sup> ± 131,42	7,20	1.872,78 <sup>b</sup> ± 159,67	8,53	1.363,44 <sup>d</sup> ± 109,15	8,01	2.093,22 <sup>a</sup> ± 166,8	7,97

*Note: In horizontal rows, mean numbers with different letters are statistically significant ( $P < 0.05$ ).*

### 3.1.2.3. Age of sexual maturity and weight of crossbred ZL and LZ hens

The results in table 3.3 show that the age of sexual maturity are not significant different between experimental groups. The time of laying 5% is from 143.67-148.67 days, in which the ZL and LZ hybrid chickens lay earlier than VCN-Z15 and LV<sub>1</sub> chickens. The laying age of 30% in ZL chickens was 164.33 days, laying earlier than LZ chickens (166 days). However, when the laying rate reached 50%, the ZL chickens laid the earliest (175,33 days) which is earlier than the LZ chickens. The highest laying rate of ZL and LZ chickens was 217 days which is similar to VCN-Z15 but it is later than LV<sub>1</sub>. The largest body weight is LV<sub>1</sub>, when laying 5%, 30% and 50% of LV<sub>1</sub> hens, the weight is 2,170.67g; 2,295.33g and 2,374.78g respectively; VCN-Z15 chicken has the smallest weight, 1,406.33g, 1,512.11g and 1,571.67g respectively. Chickens of the two breeds ZL and LZ have almost the same weight; chicken ZL is 1,854.00g; 1,958.00g and 2,027.89g; LZ chickens gained the weight of 1,901.33g, 1,980.00g and 2,069.67g respectively.

**Table 3.3. Age of laying and body weight of experimental hens**

Items	Group 1	Group 2	Group 3	Group 4
	ZL chicken	LZ chicken	VCN-Z15 chicken	LV <sub>1</sub> chicken
<b>1. Age of laying (Unit: day; n = 3)</b>				
Laying rate 5%	145,00	143,67	147,67	148,67
Laying rate 30%	164,33	166,00	165,00	168,00
Laying rate 50%	175,33	180,33	180,33	179,00
Laying highest rate	217,00	217,00	217,00	210,00
<b>2. Body weight of hen (Unit: g; n = 90)</b>				
Laying rate 5%	1.854,00	1.901,33	1.406,33	2.170,67
Laying rate 30%	1.958,00	1.980,00	1.512,11	2.295,33
Laying rate 50%	2.027,89	2.069,67	1.571,67	2.374,78

### 3.1.2.4. Laying rate and egg productivity of ZL and LZ hen

**Table 3.4. Laying rate and egg productivity of experimental chicken (n=3)**

Period (week of age)	Group 1 ZL chicken		Group 2 LZ chicken		Group 3 VCN-15 chicken		Group 4 LV <sub>1</sub> chicken	
	Laying rate (%)	egg/hen (egg)	Laying rate (%)	egg/hen (egg)	Laying rate (%)	egg/hen (egg)	Laying rate (%)	egg/hen (egg)
21-22	5,90	0,83	8,52	1,19	5,46	0,76	6,51	0,91
23-24	20,27	3,66	23,62	4,50	26,16	4,43	23,45	4,19
25-26	47,72	10,35	42,17	10,40	46,22	10,90	41,56	10,01
27-28	59,18	18,63	59,13	18,68	58,63	19,10	58,39	18,19
29-30	63,76	27,56	61,93	27,35	64,59	28,15	61,13	26,75
31-32	66,78	36,91	62,92	36,16	66,71	37,49	60,76	35,25
33-34	60,95	45,44	60,43	44,62	61,46	46,09	58,47	43,44
35-36	59,99	53,84	59,24	52,92	59,23	54,38	57,28	51,46
37-38	53,29	61,30	55,62	60,70	57,95	62,50	54,41	59,07
39-40	52,12	68,60	57,34	68,73	59,41	70,81	55,13	66,79
41-42	50,41	75,65	56,76	76,68	59,37	79,13	51,59	74,01
43-44	53,62	83,16	53,54	84,17	59,62	87,47	54,39	81,63
45-46	56,49	91,07	53,84	91,71	59,16	95,75	51,44	88,83
47-48	54,13	98,65	53,55	99,20	58,08	103,89	50,18	95,86
49-50	54,44	106,27	54,50	106,84	57,42	111,92	50,00	102,86
51-52	54,30	113,87	51,81	114,09	56,96	119,90	49,42	109,77
53-54	54,12	121,45	51,33	121,28	55,11	127,61	48,99	116,63
55-56	54,33	129,05	52,05	128,56	54,04	135,18	47,56	123,29
57-58	55,67	136,85	51,90	135,83	52,46	142,52	48,82	130,12
59-60	53,52	144,34	46,99	142,41	51,44	149,72	44,12	136,30
61-62	53,19	151,79	48,11	149,14	48,80	156,56	45,51	142,67
63-64	53,11	159,22	46,13	155,60	47,54	163,21	44,04	148,84
65-66	47,83	165,92	45,20	161,93	41,08	168,96	41,40	154,64
67-68	39,59	171,46	36,14	166,99	38,25	174,32	33,52	159,33
69-70	32,79	176,05	24,77	170,46	31,83	178,77	25,01	162,83
71-72	28,33	180,02	21,59	173,48	25,65	182,37	19,41	165,55
<b>21-72</b>	<b>49,45</b>	<b>180,02<sup>b</sup></b>	<b>47,66</b>	<b>173,48<sup>c</sup></b>	<b>50,10</b>	<b>182,37<sup>a</sup></b>	<b>45,48</b>	<b>165,55<sup>d</sup></b>
<b>Heterosis (%)</b>	<b>3,48</b>	<b>3,48</b>	<b>- 0,28</b>	<b>- 0,28</b>				

Note: In horizontal rows, mean numbers with different letters are statistically significant ( $P < 0.05$ ).

The laying rate of 4 groups (table 3.4) is highest at 31-32 week of age. The laying rate of ZL chicken is highest (66,78%) which is equivalent to VCN-Z15 chickens (66.71%) but higher (3.86%) than the peak laying rate of LZ chickens (62.92%). The highest laying rate of LV<sub>1</sub> chicken is lowest (61,13%). The egg productivity per hen of 21-72 week of age of VCN-Z15 chicken is highest (182.37 eggs). The egg productivity per hen of 21-72 week of age of ZL, LZ chicken is 180.02 eggs and 173.48 eggs. The egg productivity per hen of 21-72 week of age of LV<sub>1</sub> chicken is lowest (165.55 eggs). The difference in egg productivity between groups is statistically significant with  $P < 0.05$ . Thus, it can be seen that ZL hybrid chickens have much higher egg productivity per hen than LZ chickens (6,54 eggs, equivalent to 3.77%) with heterosis is 3.48% and -0.28%, respectively.

### 3.1.2.5. Feed consumption per 10 eggs of ZL and LZ chicken

Table 3.5 shows that feed consumption per 10 eggs at 52 weeks of ZL chicken is 2.59 kg. ZL chicken is 2.70 kg with  $P < 0.05$ . The heterosis is - 4.10% with ZL chicken.

**Table 3.5. Feed consumption per 10 eggs of experimental chicken (Unit: kg, n= 3)**

Period (week of age)	Group 1	Group 2	Group 3	Group 4
	ZL chicken	LZ chicken	VCN-15 chicken	LV <sub>1</sub> chicken
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
21-22	19,10 <sup>ab</sup> ± 3,63	13,4 <sup>b</sup> ± 1,71	20,28 <sup>a</sup> ± 1,74	20,17 <sup>a</sup> ± 4,58
23-24	5,70 <sup>a</sup> ± 0,98	4,94 <sup>a</sup> ± 0,4	4,34 <sup>a</sup> ± 0,97	5,79 <sup>a</sup> ± 0,38
25-26	2,62 <sup>c</sup> ± 0,17	2,94 <sup>b</sup> ± 0,11	2,39 <sup>c</sup> ± 0,21	3,35 <sup>a</sup> ± 0,16
27-28	2,14 <sup>b</sup> ± 0,05	2,19 <sup>b</sup> ± 0,05	1,88 <sup>c</sup> ± 0,09	2,45 <sup>a</sup> ± 0,10
29-30	1,98 <sup>c</sup> ± 0,10	2,15 <sup>b</sup> ± 0,04	1,80 <sup>d</sup> ± 0,04	2,44 <sup>a</sup> ± 0,08
31-32	1,96 <sup>c</sup> ± 0,07	2,20 <sup>b</sup> ± 0,07	1,75 <sup>d</sup> ± 0,05	2,46 <sup>a</sup> ± 0,13
33-34	2,18 <sup>b</sup> ± 0,04	2,30 <sup>b</sup> ± 0,10	1,90 <sup>c</sup> ± 0,10	2,56 <sup>a</sup> ± 0,14
35-36	2,22 <sup>b</sup> ± 0,1	2,34 <sup>b</sup> ± 0,12	1,97 <sup>c</sup> ± 0,08	2,62 <sup>a</sup> ± 0,19
37-38	2,50 <sup>a</sup> ± 0,06	2,49 <sup>b</sup> ± 0,14	2,02 ± 0,06	2,76 <sup>a</sup> ± 0,23
39-40	2,54 <sup>a</sup> ± 0,13	2,36 <sup>b</sup> ± 0,02	1,97 <sup>c</sup> ± 0,09	2,66 <sup>a</sup> ± 0,02
41-42	2,63 <sup>b</sup> ± 0,09	2,34 <sup>c</sup> ± 0,05	1,98 <sup>d</sup> ± 0,09	2,78 <sup>a</sup> ± 0,07
43-44	2,47 <sup>b</sup> ± 0,07	2,48 <sup>b</sup> ± 0,05	1,97 <sup>c</sup> ± 0,05	2,64 <sup>a</sup> ± 0,03
45-46	2,35 <sup>b</sup> ± 0,08	2,47 <sup>b</sup> ± 0,17	1,98 <sup>c</sup> ± 0,01	2,82 <sup>a</sup> ± 0,20
47-48	2,46 <sup>ab</sup> ± 0,04	2,49 <sup>ab</sup> ± 0,16	2,02 <sup>b</sup> ± 0,01	2,93 <sup>a</sup> ± 0,46
49-50	2,45 <sup>b</sup> ± 0,09	2,44 <sup>b</sup> ± 0,14	2,04 <sup>c</sup> ± 0,05	2,92 <sup>a</sup> ± 0,30
51-52	2,41 <sup>b</sup> ± 0,06	2,47 <sup>b</sup> ± 0,07	2,05 <sup>c</sup> ± 0,05	2,93 <sup>a</sup> ± 0,12
53-54	2,37 <sup>b</sup> ± 0,06	2,50 <sup>b</sup> ± 0,05	2,13 <sup>c</sup> ± 0,12	2,95 <sup>a</sup> ± 0,12
55-56	2,36 <sup>b</sup> ± 0,05	2,46 <sup>b</sup> ± 0,02	2,17 <sup>c</sup> ± 0,13	3,04 <sup>a</sup> ± 0,13
57-58	2,3 <sup>bc</sup> ± 0,04	2,47 <sup>b</sup> ± 0,06	2,19 <sup>c</sup> ± 0,27	2,96 <sup>a</sup> ± 0,08
59-60	2,40 <sup>c</sup> ± 0,04	2,72 <sup>b</sup> ± 0,09	2,17 <sup>d</sup> ± 0,05	3,29 <sup>a</sup> ± 0,08
61-62	2,41 <sup>c</sup> ± 0,06	2,67 <sup>b</sup> ± 0,20	2,29 <sup>c</sup> ± 0,09	3,20 <sup>a</sup> ± 0,09
63-64	2,41 <sup>c</sup> ± 0,19	2,78 <sup>b</sup> ± 0,16	2,35 <sup>c</sup> ± 0,05	3,31 <sup>a</sup> ± 0,08
65-66	2,67 <sup>b</sup> ± 0,11	2,73 <sup>b</sup> ± 0,07	2,72 <sup>b</sup> ± 0,01	3,40 <sup>a</sup> ± 0,20
67-68	3,24 <sup>b</sup> ± 0,24	3,43 <sup>b</sup> ± 0,29	2,92 <sup>b</sup> ± 0,05	4,22 <sup>a</sup> ± 0,40
69-70	3,79 <sup>b</sup> ± 0,35	5,03 <sup>a</sup> ± 0,50	3,54 <sup>b</sup> ± 0,38	5,59 <sup>a</sup> ± 0,65
71-72	4,37 <sup>c</sup> ± 0,13	5,80 <sup>b</sup> ± 0,63	4,44 <sup>c</sup> ± 0,7	6,98 <sup>a</sup> ± 0,50
<b>21-72</b>	<b>2,59<sup>c</sup> ± 0,01</b>	<b>2,70<sup>b</sup> ± 0,03</b>	<b>2,26<sup>d</sup> ± 0,03</b>	<b>3,14<sup>a</sup> ± 0,02</b>
<b>Heterosis (%)</b>	<b>- 4,10</b>			

Note: In horizontal rows, mean numbers with different letters are statistically significant ( $P < 0.05$ ).

### 3.1.2.6. Egg weight and some egg quality indicators of ZL and LZ chicken

The egg weight of ZL chicken is 54.67 g and LZ chicken is 55g which is higher than egg weight of VCN-Z15 (53,44g), however that is smaller than eeg weight of LV<sub>1</sub> chicken (55,59g).

Shape index, eggshell thickness, Haugh unit of egg of ZL and LZ chicken are 1.33; 0.33 mm, 80.28 and 1.33, 0.33mm, 79.90 respectively. The results are similar to the the results of Tran Thi

Hoan et all. (2020) surveyed the egg of F1 Dong Tao chicken (Dong Tao x LV) with Shape index, eggshell thickness, Haugh unit are 1,32; 0,33mm; 83,67 respectively. Rate of yolk and yolk index of Zl and LZ chicken are similar which are 30,07%; 0,40 và 29,80%, 0,40 respectively

**Table 3.6. The results of egg survey at 38 week of age of experimental chicken**

(n = 90 egg/group)

Items	Group 1	Group 2	Group 3	Group 4
	ZL chicken	LZ chicken	VCN-15 chicken	LV <sub>1</sub> chicken
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
Egg weight (g)	54,67 ± 2,87	55,00 ± 3,09	53,44 ± 2,84	55,59 ± 3,07
Shape index	1,33 ± 0,05	1,33 ± 0,05	1,33 ± 0,05	1,34 ± 0,06
Rate of yolk (%)	30,07 ± 2,11	29,80 ± 2,62	31,16 ± 2,62	29,10 ± 2,20
Yolk index	0,40 ± 0,03	0,40 ± 0,02	0,40 ± 0,03	0,40 ± 0,03
Eggshell thickness (mm)	0,33 ± 0,03	0,33 ± 0,02	0,34 ± 0,03	0,32 ± 0,02
Haugh unit (HU)	80,28 ± 2,56	79,90 ± 4,54	80,67 ± 2,67	79,65 ± 2,45

**3.1.2.7. Rate of breeding eggs and hatching results of ZL và LZ chicken**

Table 3.7 shows that breeding rate at all 4 groups is 93.04 – 93.99%, in which breeding rate of ZL chicken is 93.29% which is higher than that of LZ chicken (93.04%). The rate of egg with embryos and rate of First class chick per total hatching eggs is quite high and there is not different between experimental groups. The rate of egg with embryos is 94.87-95.36%; the rate of First class chick per total hatching eggs is 80.42-81.62%.

**Table 3.7. Rate of breeding eggs and hatching results of experimental chicken**

Items	ĐVT	Group 1	Group 2	Group 3	Group 4
		ZL chicken	LZ chicken	VCN-15 chicken	LV <sub>1</sub> chicken
		Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
Rate of breeding egg	%	93,29 ± 0,78	93,04 ± 1,12	93,99 ± 0,50	93,55 ± 0,99
Total of hatched egg	egg	6.196	6.030	6.393	5.843
The number of hatching	lot	11	11	11	11
Rate of egg with embryos	%	95,36 ± 0,42	94,95 ± 0,78	94,90 ± 0,50	94,87 ± 0,80
First class chick per total hatched eggs	%	81,59 ± 0,50	81,42 ± 0,39	81,62 ± 0,72	80,42 ± 1,10

**3.1.2.8. Feed cost of one first class chick of ZL and LZ chicken**

The feed cost for one hen to 72 week of age of LV<sub>1</sub> chicken (579.160 VND) is the highest. The feed cost for one hen of ZL and LZ chicken is similar which is 519.419 VND and 525.494 VND respectively. The feed cost for one hen of VCN-Z15 chicken is the lowest (465.614 VND). However, The feed cost for one first class chick of ZL chicken (3.790 VND) is lower 5.51% than LZ chicken (3.999 VND) and lower 22.69% compared to LV<sub>1</sub> chicken. This result reveals that using the ZL chicken as the laying hen for breeding is economical.

**Table 3.8. The feed cost for one first class chick of experimental chicken**

<b>Items</b>	<b>Group 1 ZL chicken</b>	<b>Group 2 LZ chicken</b>	<b>Group 3 VCN-Z15 chicken</b>	<b>Group 4 LV<sub>1</sub> chicken</b>
<i>1. Chick (01day old-6 week)</i>				
Feed price (VND/kg)	11.600	11.600	11.600	11.600
Feed/chicken (kg)	1,64	1,64	1,49	1,79
Feed cost (đ)	19.024	19.024	17.284	20.764
<i>2. Growing, Gilts (7-20 week)</i>				
Feed price (VND/kg)	9.500	9.500	9.500	9.500
Feed/chicken (kg)	7,69	7,70	7,10	8,44
Feed cost (VND)	73.055	73.150	67.450	80.180
<i>3. Laying hen (21-72 week)</i>				
Feed price (VND/kg)	9.200	9.200	9.200	9.200
Feed/chicken (kg)	46,45	47,01	41,40	51,98
Feed cost (VND)	427.340	433.320	380.880	478.216
<i>4. Feed cost/1 hen (VND)</i>	<i>519.419</i>	<i>525.494</i>	<i>465.614</i>	<i>579.160</i>
<i>5. Number first class chick/hen</i>	<i>137</i>	<i>131</i>	<i>140</i>	<i>125</i>
<b><i>6. Feed cost/1 first class chick (VND)</i></b>	<b><i>3.790</i></b>	<b><i>3.999</i></b>	<b><i>3.328</i></b>	<b><i>4.650</i></b>

In summary, with the results of the study on 2 hybrid hens between VCN-Z15 and LV<sub>1</sub> chickens, ZL hybrid hen has a high survival rate up to 20 weeks of age (95%), body weight at 20 weeks of age is high equivalent between individual; egg yield/hen/72 weeks of age reached 180.02 eggs and heterosis is 3.48%. Egg weight is 54.67g. Hatching rate of first class chick/total hatching eggs is high (81.59%); Feed consumption per 10 eggs is low (2.59 kg); feed cost per 1 first class chick is 3,790 VND. Compared with the LZ hybrid chicken, the production parameters were higher and the feed consumption was lower. Therefore, ZL chicken was selected as a breeding hen for crossbreeding with native chicken breeds (Ri and Lac Thuy) to create a cross of 3 breeds with high meat quality.

## **3.2. SOME APPEARANCE CHARACTERISTICS, YIELD AND MEAT QUALITY OF THREE HYBRE CHICKEN RZL AND LTZL**

### **3.2.1. Some appearance characteristics of hybrid chicken RZL và LTZL**

**Table 3.9. appearance characteristics of hybrid chicken RZL và LTZL at 16 weeks of age**

Gender	Explanation	Unit	Group 1	Group 2	Group 3	Group 4
			RZL chicken	LTZL chicken	Ri chicken	Lac Thuy chicken
Cock	Number of chicken	chicken	92	82	95	92
	- Color feather					
	+ Ripe plum color	%	18,5	17,1		100
	+ Bright straw yellow, yellow belly and chest hair	%	71,7	48,8		
	+ Dark straw yellow, black belly and chest hair	%	9,8	34,1		
	+ Straw yellow color	%			100	
	- Yellow peak, yellow leg, yellow skin	%	100	100	100	100
	- Red flag crest	%	100	100	100	100
Hen	Number of chicken	chicken	98	106	97	101
	- Color feather					
	+ Yellow owl spot color	%	22,4	26,5	10,1	
	+ Black owl spot color	%	43,9	49,1		
	+ Straw yellow	%	33,7	22,6	89,9	
	+ Pale brown	%		1,8		94,1
	+ Gray brown	%				4,0
	+ Soil brown	%				1,9
	- Yellow peak, yellow leg, yellow skin	%	100	100	100	100
- Red flag crest color	%	100	100	100	100	

### 3.2.2. Survival rate of RZL and LTZL chicken

**Table 3.10. Survival rate of RZL và LTZL chicken (Unit: %; n=4)**

Week of age	Group 1	Group 2	Group 3	Group 4
	RZL chicken	LTZL chicken	Ri chicken	Lac Thuy chicken
1	99,50	99,00	99,50	100,00
6	97,50	96,00	96,50	97,50
12	96,50	95,00	96,00	97,00
16	95,00	94,00	96,00	96,50

From the results in Table 3.10, it shows that the survival rate from 1-16 weeks of age of all 4 experimental chicken batches was high, at 16 weeks of age, it reached from 94-96.5%, However, hybrid chickens have a lower survival rate than Ri (96%) and Lac Thuy (96.5%) from 1-2.5%, which proves that native chickens still have good vitality, high disease resistance, and adaptability. with better environmental conditions. The survival rate of RZL chickens reached 95%, higher than LTZL chickens reaching 94%.

### 3.2.3. Growing ability of 3 hybrid chicken RZL and LTZL

#### Cumulative growth of 3 hybrid chicken RZL and LTZL

The body weight of the 1 day old of RZL and LTZL chicken is larger than the weight of Ri and Lac Thuy chicken. The body weight of RZL and LTZL chicken is 31.75g and 30.15g

with ( $P < 0.05$ ). The body weight of RZL and LTZL chicken at 16 weeks of age is significantly higher than that of Ri chicken and Lac Thuy chicken. Body weight of RZL chicken reached 1,911.33g which is higher 25.41% than the weight of Ri chickens (1,524.08g). Body weight of LTZL chicken reached 1,888.75g which is higher 11.07% than the weight of Lac Thuy chicken (1,700.50g). At 16 weeks of age, the body weight of hybrid chicken RZL and LTZL was significantly different from Ri chicken and Lac Thuy chicken with  $P < 0.05$ ; However, the body weight of hybrid chicken RZL and LTZL was not statistically significant different,  $P > 0.05$ .

**Table 3.11. Cumulative growth of experimental chicken** (Unit: g/chicken;  $n = 120$ )

Week of age	Group 1		Group 2		Group 3		Group 4	
	RZL chicken		LTZL chicken		Ri chicken		Lac Thuy chicken	
	Mean $\pm$ SE	CV (%)	Mean $\pm$ SE	CV (%)	Mean $\pm$ SE	CV (%)	Mean $\pm$ SE	CV (%)
01 day old	31,75 <sup>a</sup> $\pm$ 0,23	7,99	30,15 <sup>b</sup> $\pm$ 0,20	7,37	28,25 <sup>d</sup> $\pm$ 0,14	5,32	28,75 <sup>c</sup> $\pm$ 0,12	4,54
1	87,38 <sup>a</sup> $\pm$ 0,48	6,02	85,61 <sup>b</sup> $\pm$ 0,65	8,32	57,23 <sup>d</sup> $\pm$ 0,50	9,62	81,28 <sup>c</sup> $\pm$ 0,77	10,43
6	603,00 <sup>a</sup> $\pm$ 8,90	16,18	577,83 <sup>b</sup> $\pm$ 7,55	14,31	466,17 <sup>d</sup> $\pm$ 6,04	14,19	541,75 <sup>c</sup> $\pm$ 6,05	12,24
12	1.468,08 <sup>a</sup> $\pm$ 19,23	14,35	1.446,67 <sup>a</sup> $\pm$ 17,82	13,49	1.185,58 <sup>c</sup> $\pm$ 15,12	13,97	1.327,50 <sup>b</sup> $\pm$ 12,84	10,60
16	1.911,33 <sup>a</sup> $\pm$ 26,29	15,07	1.888,75 <sup>a</sup> $\pm$ 28,46	16,51	1.524,08 <sup>c</sup> $\pm$ 21,88	15,73	1.700,50 <sup>b</sup> $\pm$ 16,11	10,38

Note: In horizontal rows, mean numbers with different letters are statistically significant ( $P < 0.05$ ).

### 3.2.4. Feed intake ability of hybrid chicken RZL và LTZL

Feed intake ability of RZL and LTZL chickens (Table 3.12) increased gradually over weeks of age which was higher than that of Ri and Lac Thuy chickens. This is completely in line with the growing rules of chicken. Up to 16 weeks of age, the feed intake ability of RZL chickens was 102.38g/chicken/day, and that of LTZL chickens was 101.08g/chicken/day. Calculate the total amount of feed that RZL and LTZL chickens received during the period from 1-16 weeks of age, respectively 6,586.83g and 6,536.95g. This difference is not statistically significant ( $P > 0.05$ ). However, between chickens crossed with Ri chickens with 5,847.45g and Lac Thuy chickens at 6,041.18g, there is a difference with  $P < 0.05$ .

**Table 3.12. Feed intake ability of experimental chicken** (Unit: g/chicken/day;  $n = 4$ )

Week of age	Group 1	Group 2	Group 3	Group 4
	RZL chicken	LTZL chicken	Ri chicken	Lac Thuy chicken
	Mean $\pm$ SE	Mean $\pm$ SE	Mean $\pm$ SE	Mean $\pm$ SE
1	8,50 <sup>a</sup> $\pm$ 0,37	8,80 <sup>a</sup> $\pm$ 0,15	7,20 <sup>b</sup> $\pm$ 0,11	7,18 <sup>b</sup> $\pm$ 0,12
6	40,73 <sup>a</sup> $\pm$ 0,55	42,83 <sup>a</sup> $\pm$ 2,15	34,85 <sup>b</sup> $\pm$ 1,02	40,20 <sup>a</sup> $\pm$ 0,69
12	87,20 <sup>a</sup> $\pm$ 1,95	82,48 <sup>a</sup> $\pm$ 1,57	73,98 <sup>b</sup> $\pm$ 1,91	76,43 <sup>b</sup> $\pm$ 2,06
16	102,38 <sup>a</sup> $\pm$ 1,02	101,08 <sup>a</sup> $\pm$ 0,55	94,95 <sup>b</sup> $\pm$ 0,97	95,43 <sup>b</sup> $\pm$ 0,36
<b>Sum 1-16 (g)</b>	6.586,83 <sup>a</sup>	6.536,95 <sup>a</sup>	5.847,45 <sup>b</sup>	6.041,18 <sup>b</sup>

Note: In horizontal rows, mean numbers with different letters are statistically significant ( $P < 0.05$ ).



### 3.2.5. Feed consumption/kg body weight gain of three hybrid chickens RZL và LTZL

Feed consumption of RZL and LTZL chickens in Table 3.13 increased by week of age. Feed consumption of RZL and LTZL chickens at the first week of age was the lowest which is 1.07 kg and 1.11 kg of feed/kg body weight gain, respectively. Feed consumption tends to increase gradually and reaches the highest until the 16th week which is 3.50 kg and 3.52 kg of feed/kg body weight gain, respectively. This difference is not statistically significant ( $P>0.05$ ).

**Table 3.13. Feed consumption/kg body weight gain of experimental chicken (Unit: kg; n=4 )**

Week of age	Group 1 RZL chicken		Group 2 LTZL chicken		Group 3 Ri chicken		Group 4 Lac Thuy chicken	
	Mean $\pm$ SE	CV (%)	Mean $\pm$ SE	CV (%)	Mean $\pm$ SE	CV (%)	Mean $\pm$ SE	CV (%)
1	1,07 <sup>bc</sup> $\pm$ 0,03	7,70	1,11 <sup>b</sup> $\pm$ 0,02	5,32	1,74 <sup>a</sup> $\pm$ 0,01	3,21	0,96 <sup>c</sup> $\pm$ 0,02	6,06
6	1,86 <sup>a</sup> $\pm$ 0,07	7,72	2,00 <sup>a</sup> $\pm$ 0,11	11,21	2,14 <sup>a</sup> $\pm$ 0,08	8,26	1,97 <sup>a</sup> $\pm$ 0,06	6,60
12	2,67 <sup>b</sup> $\pm$ 0,06	4,62	2,74 <sup>ab</sup> $\pm$ 0,08	6,00	2,91 <sup>a</sup> $\pm$ 0,05	3,30	2,71 <sup>ab</sup> $\pm$ 0,05	3,50
16	3,50 <sup>b</sup> $\pm$ 0,05	2,91	3,52 <sup>b</sup> $\pm$ 0,07	4,28	3,84 <sup>a</sup> $\pm$ 0,05	2,54	3,61 <sup>b</sup> $\pm$ 0,07	4,02

Note: In horizontal rows, mean numbers with different letters are statistically significant ( $P<0.05$ ).

### 3.2.6. Production index and economic index of three hybrid chickens RZL and LTZL

The results of table 3.14 shows that up to 16 weeks of age, the production index of RZL chickens was highest, reaching 46.99; then the chicken LTZL reached 45.07. Ri and Lac Thuy chickens had a much lower production index than 3 hybrid chickens, reaching 33.42 in 40.54. Economic index also showed similar results, at 16 weeks of age, the economic index of RZL chicken was 1.03 and LTZL chicken was 0.99 which are higher than that of Ri chicken (0.66) and Lac Thuy chicken (0.85) .

**Table 3.14. Production index and economic index of experimental chickens**

Week of age	Group 1 RZL chicken	Group 2 LTZL chicken	Group 3 Ri chicken	Group 4 Lac Thuy chicken
<b>1. Production Index</b>				
10	71,47	65,47	52,55	63,38
11	68,37	63,44	50,50	60,47
12	63,50	59,79	46,59	56,34
13	57,91	55,53	42,48	51,51
14	53,92	52,13	38,68	47,11
15	50,39	48,41	35,82	43,78
16	46,99	45,07	33,42	40,54
<b>2. Economic index</b>				
10	2,39	2,06	1,60	2,03
11	2,13	1,89	1,45	1,85
12	1,83	1,68	1,23	1,60
13	1,56	1,46	1,03	1,33
14	1,35	1,27	0,87	1,13
15	1,17	1,12	0,75	0,97
16	1,03	0,99	0,66	0,85

### 3.2.7. Production and meat quality of 3 hybrid chicken RZL and LTZL

#### 3.2.7.1. Meat production of 3 hybrid chicken RZL and LTZL

**Table 3.15. Meat production of experimental chickens (n=24)**

Items	Group 1	Group 2	Group 3	Group 4
	RZL chicken	LTZL chicken	Ri chicken	Lac Thuy chicken
	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE
Live body weight (g)	1.899,67 <sup>a</sup> ± 72,36	1.740,29 <sup>a</sup> ± 75,52	1.485,96 <sup>b</sup> ± 41,77	1.560,33 <sup>b</sup> ± 42,45
Carcass weight(g)	1.433,42 <sup>a</sup> ± 54,03	1.299,63 <sup>b</sup> ± 56,72	1.132,96 <sup>c</sup> ± 31,28	1.180,29 <sup>bc</sup> ± 36,65
Carcass meat rate (%)	75,46	74,68	76,24	75,64
Thigh meat (g)	282,08 <sup>a</sup> ± 11,94	240,58 <sup>b</sup> ± 12,87	246,33 <sup>b</sup> ± 10,59	255,17 <sup>ab</sup> ± 7,84
Thigh meat rate (%)	19,68	18,51	21,74	21,62
Breast meat (g)	223,25 <sup>a</sup> ± 6,60	196,42 <sup>b</sup> ± 8,24	174,00 <sup>c</sup> ± 3,63	184,00 <sup>bc</sup> ± 6,01
Breast meat rate (%)	15,57	15,11	15,36	15,59
Belly fat weight (g)	28,29 <sup>b</sup> ± 1,41	35,75 <sup>a</sup> ± 2,46	30,54 <sup>ab</sup> ± 2,99	16,71 <sup>c</sup> ± 0,73
Belly fat rate (%)	1,97	2,75	2,70	1,42

*Note: In horizontal rows, mean numbers with different letters are statistically significant (P<0.05).*

The results of slaughtering and surveying experimental chickens are shown in Table 3.15. The carcass weight of RZL chickens was the highest, with an average of 1,433.42g male and female; higher than that of the LTZL chicken (1,299.63g). The carcass weight of Lac Thuy chicken was 1,180.29g and the lowest for Ri chicken was 1,132.96g. There was a statistically significant difference between carcass weight between experimental groups with P<0.05. The carcass percentage of RZL chicken is 75.46%, higher than that of LTZL chicken (74.68%). The carcass percentage of crossbred chickens is nearly equivalent to that of Ri chicken (76.24%) and Lac Thuy chicken (75.64%). The percentage of thigh meat of RZL chicken is 19.68%, 18.51% higher than that of LTZL chicken, lower than that of Ri chicken (21.74%) and Lac Thuy chicken (21.62%). The percentage of breast meat is lower than the percentage of thigh meat. The proportion of breast meat of three hybrid chickens RZL and LTZL is similar to that of Ri and Lac Thuy chicken which is 15.57%; 15.11%; 15.36% and 15.59%, respectively. The percentage of belly fat in 4 experimental groups was low, in which Lac Thuy chicken is the lowest (1.42%). RZL chicken is 1.97%. LTZL chicken is 2.75% and Ri chicken is 2.70%.

### 3.2.7.2. Meat quality of 3 hybrid chicken RZL and LTZL

**Table 3.16. Meat quality of experimental chickens (n=3)**

Items	Meat analysis	RZL chicken	LTZL chicken	Ri chicken	Lac Thuy chicken
		Mean $\pm$ SE	Mean $\pm$ SE	Mean $\pm$ SE	Mean $\pm$ SE
pH (15 minute)	Thigh	6,26 $\pm$ 0,07	6,38 $\pm$ 0,08	6,40 $\pm$ 0,07	6,19 $\pm$ 0,07
	Breast	6,08 <sup>b</sup> $\pm$ 0,07	6,09 <sup>b</sup> $\pm$ 0,04	6,37 <sup>a</sup> $\pm$ 0,06	6,06 <sup>b</sup> $\pm$ 0,08
pH (24 h)	Thigh	5,87 <sup>a</sup> $\pm$ 0,04	5,82 <sup>ab</sup> $\pm$ 0,02	5,73 <sup>b</sup> $\pm$ 0,04	5,75 <sup>b</sup> $\pm$ 0,03
	Breast	5,62 <sup>ab</sup> $\pm$ 0,02	5,65 <sup>a</sup> $\pm$ 0,03	5,55 <sup>b</sup> $\pm$ 0,04	5,64 <sup>a</sup> $\pm$ 0,02
Brightness L *	Thigh	45,27 <sup>b</sup> $\pm$ 1,05	45,28 <sup>b</sup> $\pm$ 0,72	48,87 <sup>a</sup> $\pm$ 0,72	45,76 <sup>b</sup> $\pm$ 0,97
	Breast	56,04 $\pm$ 1,41	53,67 $\pm$ 1,83	55,01 $\pm$ 1,01	56,33 $\pm$ 0,28
Redness a *	Thigh	15,10 <sup>ab</sup> $\pm$ 0,24	16,58 <sup>a</sup> $\pm$ 0,59	14,76 <sup>b</sup> $\pm$ 0,55	16,36 <sup>a</sup> $\pm$ 0,50
	Breast	9,64 $\pm$ 0,26	10,62 $\pm$ 0,48	9,48 $\pm$ 0,50	10,48 $\pm$ 0,30
Yellowness b *	Thigh	9,84 <sup>bc</sup> $\pm$ 0,36	8,73 <sup>c</sup> $\pm$ 0,56	13,43 <sup>a</sup> $\pm$ 0,82	11,48 <sup>a</sup> $\pm$ 0,36
	Breast	20,97 $\pm$ 0,73	20,00 $\pm$ 1,22	18,99 $\pm$ 0,88	21,60 $\pm$ 0,35
Preservation dehydration rate (%)	Thigh	0,38 $\pm$ 0,04	0,54 $\pm$ 0,08	0,40 $\pm$ 0,11	0,63 $\pm$ 0,10
	Breast	0,99 $\pm$ 0,17	0,94 $\pm$ 0,10	1,05 $\pm$ 0,20	0,87 $\pm$ 0,09
Processing dehydration rate (%)	Thigh	19,93 <sup>b</sup> $\pm$ 1,26	24,32 <sup>a</sup> $\pm$ 0,67	21,64 <sup>ab</sup> $\pm$ 1,15	21,75 <sup>a</sup> $\pm$ 0,90
	Breast	16,82 <sup>a</sup> $\pm$ 0,99	13,82 <sup>b</sup> $\pm$ 0,68	15,29 <sup>ab</sup> $\pm$ 0,63	17,80 <sup>a</sup> $\pm$ 0,95
Meat toughness (Newton)	Thigh	27,64 <sup>ab</sup> $\pm$ 1,57	30,15 <sup>a</sup> $\pm$ 0,99	25,84 <sup>b</sup> $\pm$ 1,09	28,06 <sup>ab</sup> $\pm$ 1,53
	Breast	21,60 $\pm$ 0,72	25,30 $\pm$ 0,98	25,04 $\pm$ 1,66	22,42 $\pm$ 1,33

*Note: In horizontal rows, mean numbers with different letters are statistically significant ( $P < 0.05$ ).*

The data in table 3.16 show that, the 15-minute pH of RZL and LTZL chickens has no significant difference, reaching 6.26; 6.38 in thigh meat and 6.08; 6.09 in breast meat which is equivalent to Ri and Lac Thuy chickens. After 24 hours, the pH value of both thigh meat and breast meat decreased significantly, to 5.87; 5.82 in thigh meat and 5.62; 5.65 in breast meat.

About meat color: breast meat has a higher brightness than thigh meat which reached 56.04 in RZL chicken and 53.67 in LTZL chicken; thigh meat reaches 45.28 and 45.27 respectively. The rate of dehydration preserved breast meat is higher than thigh meat which is 0.99% in breast meat and 0.38% in thigh meat of RZL chicken and 0.94% and 0.54% of LTZL chicken, respectively. The rate of processed dehydration in thigh meat is higher than breast meat, respectively 19.93%; 16.82% in RZL chicken and 24.32%; 13.82% in LTZL chicken.

In terms of meat toughness: thigh meat is tougher than breast meat. The thigh meat toughness and breast meat toughness of RZL chicken are 27.64N and 21.60N, respectively. That of LTZL chicken reach 30.15N and 25.30N respectively. The dry matter composition of thigh meat in RZL and LTZL chicken is similar which is 24.16% and 23.06%, respectively. equivalent to Lac Thuy chicken (24.33%) but lower than Ri chicken (26.64%). Breast meat tends to be similar to thigh meat.

**Table 3.17. The chemical composition of experimental chicken (n=3)**

Items	Analytical meat	Group 1	Group 2	Group 3	Group 4
		RZL chicken	LTZL chicken	Ri chicken	Lac Thuy chicken
		Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE
Dry matter (%)	Thigh	24,16 <sup>b</sup> ± 0,10	23,06 <sup>c</sup> ± 0,03	26,64 <sup>a</sup> ± 0,22	24,33 <sup>b</sup> ± 0,06
	Breast	26,27 <sup>b</sup> ± 0,02	25,63 <sup>c</sup> ± 0,04	27,38 <sup>a</sup> ± 0,23	26,11 <sup>b</sup> ± 0,03
Protein (%)	Thigh	22,37 <sup>b</sup> ± 0,06	22,32 <sup>b</sup> ± 0,03	21,11 <sup>c</sup> ± 0,10	22,60 <sup>a</sup> ± 0,03
	Breast	25,26 <sup>a</sup> ± 0,03	25,11 <sup>a</sup> ± 0,02	24,27 <sup>b</sup> ± 0,19	24,56 <sup>b</sup> ± 0,06
Lipit (%)	Thigh	2,43 <sup>b</sup> ± 0,01	3,12 <sup>c</sup> ± 0,11	3,79 <sup>a</sup> ± 0,35	2,53 <sup>bc</sup> ± 0,04
	Breast	0,57 <sup>c</sup> ± 0,02	0,61 <sup>c</sup> ± 0,01	1,31 <sup>a</sup> ± 0,07	0,83 <sup>b</sup> ± 0,01
Mineral (%)	Thigh	1,20 <sup>ab</sup> ± 0,01	1,16 <sup>b</sup> ± 0,02	1,25 <sup>a</sup> ± 0,04	0,96 <sup>c</sup> ± 0,00
	Breast	1,41 <sup>a</sup> ± 0,00	1,40 <sup>a</sup> ± 0,00	1,30 <sup>b</sup> ± 0,05	1,42 <sup>a</sup> ± 0,00

Note: In horizontal rows, mean numbers with different letters are statistically significant ( $P < 0.05$ ).

The dry matter composition of thigh meat (table 3.17) in RZL and LTZL chicken is 24.16% and 23.06% respectively which is equivalent to Lac Thuy chicken (24.33%) but lower than Ri chicken (26.64%). Breast meat tends to be similar to thigh meat.

The protein composition of thigh meat of RZL and LTZL chicken is similar (22.37% and 22.32%, respectively) which is higher than that of Ri chicken (21.11%) but lower than that of Lac Thuy (22.60%). The percentage of protein in the breast meat of hybrid chickens was higher than that of Ri and Lac Thuy chicken and higher than that of thigh meat, reaching 25.26% and 25.11% respectively. Lipid content in thigh meat of LTZL chicken (3.12%) is higher than that of other chicken breeds but lower than Ri chicken (3.79%). This indicator in breast meat is lower than that of thigh meat and is similar to the two hybrid chickens, but lower than that of Ri and Lac Thuy chicken. For the mineral index in breast meat of crossbred chickens reached from 1.40-1.41% which is equivalent to Lac Thuy chicken and higher than that of Ri chicken (1.30%); in thigh meat, the mineral rate is 1.16-1.20% of hybrid chickens which is equivalent to Ri chicken and higher than Lac Thuy chicken (0.96%).

The results of the study on the amino acid composition of meat in Table 3.18 showed that the amount of Aspartic acid is the highest, followed by Serine, Lysine, Leucine, Glutamic acid, Glycine, Alanine; Cystine has the lowest composition in meat. In particular, the Serine ratio is highest in Ri chicken (2,503.33 mg/100g), followed by RZL chicken (1,847.33mg/100g), the lowest in Lac Thuy chicken (843mg/100g) and LTZL chicken (966.67mg/100g). Glutamic acid content in crossbred chickens is higher than that of Ri chicken and Lac Thuy chicken, reaching 1,642.67mg/100g in RZL chicken and 1,565mg/100g in LTZL chicken compared with Ri chickens (1,470.33mg/100g) and Lac Thuy (1,261.33mg/100g). Similarly Alanine also tends to be higher. The concentration of Aspartic acid, Lysine, and Leucine are quite similar in the experimental groups.

**Table 3.18. The amino acid composition of experimental chicken meat***(Unit: mg/100gam; n=3)*

Order	Items	Group 1	Group 2	Group 3	Group 4
		RZL chicken	LTZL chicken	Ri chicken	Lac Thuy chicken
		Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE
1	Aspartic acid	2.336,33 <sup>a</sup> ± 2,85	2.232,33 <sup>a</sup> ± 10,93	2.793,67 <sup>a</sup> ± 451,14	2.107,00 <sup>a</sup> ± 1,15
2	Serine	1.847,33 <sup>b</sup> ± 1,20	966,67 <sup>c</sup> ± 4,48	2.503,33 <sup>a</sup> ± 316,98	843,00 <sup>c</sup> ± 2,31
3	Glutamic acid	1.642,67 <sup>a</sup> ± 4,73	1.565,00 <sup>ab</sup> ± 2,91	1.470,33 <sup>b</sup> ± 58,44	1.261,33 <sup>c</sup> ± 1,86
4	Glycine	854,33 <sup>c</sup> ± 2,33	893,67 <sup>b</sup> ± 3,71	1.348,33 <sup>a</sup> ± 23,57	772,67 <sup>d</sup> ± 2,40
5	Histidine	722,33 <sup>a</sup> ± 2,33	745,33 <sup>a</sup> ± 3,48	760,33 <sup>a</sup> ± 57,34	625,67 <sup>b</sup> ± 2,91
6	Threonine	932,00 <sup>ab</sup> ± 1,45	993,67 <sup>a</sup> ± 2,65	979,00 <sup>b</sup> ± 58,02	872,33 <sup>a</sup> ± 1,76
7	Arginine	623,67 <sup>a</sup> ± 2,03	675,33 <sup>a</sup> ± 4,10	671,33 <sup>a</sup> ± 41,18	584,00 <sup>a</sup> ± 33,05
8	Alanine	1.317,00 <sup>c</sup> ± 2,31	1.791,00 <sup>b</sup> ± 2,89	1.046,33 <sup>d</sup> ± 32,90	3.665,00 <sup>a</sup> ± 3,61
9	Proline	736,33 <sup>b</sup> ± 3,18	632,33 <sup>bc</sup> ± 2,03	939,67 <sup>a</sup> ± 83,73	507,33 <sup>c</sup> ± 0,88
10	Cystine	314,67 <sup>ab</sup> ± 1,76	317,67 <sup>ab</sup> ± 1,45	345,00 <sup>a</sup> ± 37,64	275,00 <sup>b</sup> ± 3,51
11	Tyrocine	653,00 <sup>b</sup> ± 3,06	725,00 <sup>a</sup> ± 2,65	719,67 <sup>a</sup> ± 31,67	602,00 <sup>b</sup> ± 3,06
12	Valine	816,67 <sup>ab</sup> ± 1,76	874,33 <sup>a</sup> ± 2,60	803,67 <sup>ab</sup> ± 46,23	743,33 <sup>b</sup> ± 3,28
13	Methionine	635,33 <sup>a</sup> ± 2,85	624,67 <sup>a</sup> ± 3,48	514,67 <sup>b</sup> ± 11,62	505,00 <sup>b</sup> ± 1,53
14	Lysine	2.114,33 <sup>ab</sup> ± 4,33	2.166,67 <sup>a</sup> ± 3,18	2.035,33 <sup>b</sup> ± 57,40	2.048,00 <sup>b</sup> ± 2,65
15	L-Leucine	740,67 <sup>a</sup> ± 2,60	783,33 <sup>a</sup> ± 15,45	710,67 <sup>ab</sup> ± 46,85	661,00 <sup>b</sup> ± 2,08
16	Leucine	1.669,67 <sup>a</sup> ± 6,57	1.659,67 <sup>a</sup> ± 6,98	1.657,33 <sup>a</sup> ± 132,52	1.478,33 <sup>a</sup> ± 6,77
17	Phenyl alanine	782,67 <sup>a</sup> ± 2,03	817,33 <sup>a</sup> ± 6,89	803,00 <sup>a</sup> ± 49,56	692,33 <sup>b</sup> ± 2,73
18	Tryptophan	890,33 <sup>bc</sup> ± 3,06	914,00 <sup>a</sup> ± 1,76	895,67 <sup>ab</sup> ± 10,48	874,33 <sup>c</sup> ± 2,40

Note: In horizontal rows, mean numbers with different letters are statistically significant ( $P < 0.05$ ).

### 3.4. PRODUCTION ABILITY OF TWO HYBRID HEN ZL AND LZ AND THREE HYBRID HEN RZL AND LTZL TRAIL RAISING IN HOUSEHOLD

#### 3.4.1. The results of experimental raising ZL hen in household

##### 3.4.1.1. Survival rate of chick, gilt of hybrid hen ZL

Survival rate from 1 day old to 6 week of age is high (96.47 – 96.6%). This result is due to the healthy chicken transferred to the household and the good understanding of farmer about technical raising process. At the stage of rearing gilts at 7-20 weeks of age, chicken is fed according to the level of feeding for broiler and gilts, the survival rate still reaches 95.65-96.96%. The average of survival rate from 1 to 20 week of age of household in Bac Giang is the highest (93.6%), and then Thanh Hoa (93%) and that in Quang Ninh is the lowest (92.27%).

##### 3.4.1.2. Body weight of hybrid hen ZL at the period of chick, gilt and percentage of standard reproductive hen.

The result of body weight of hen at households is showed in table 3.19. This data shows that the body weight of hen increases sharply at chick period. The body weight of hen at 20 week of age at three households is similar which is from 1,803.83 to 1,832.34 g. This result is

similar to body weight of hen which is raised in Livestock Experimentation and Conservation Center (1,825.56g).

**Table 3.19. Body weight of hybrid hen ZL at chick and gilt from 1 day old to 20 week of age.**

(Unit: g/chicken; n =60)

Week of age	Thanh Hoa	Quang Ninh	Bac Giang
1	80,08	80,73	82,42
3	280,85	283,83	296,62
5	552,00	537,42	560,32
7	701,17	711,67	716,56
9	807,33	842,00	853,13
11	993,83	1.014,00	1.120,58
13	1.127,83	1.169,23	1.228,38
15	1.485,00	1.309,50	1.530,53
17	1.568,50	1.510,17	1.623,92
18	1.616,00	1.613,00	1.653,42
19	1.730,00	1.724,67	1.784,13
<b>20</b>	<b>1.803,83</b>	<b>1.822,83</b>	<b>1.832,34</b>

The standard reproductive hen of ZL chicken at 20 week of age (table 3.20) at households is 94.19 – 95.09% and there is no different between households.

**Table 3.20. The rate of standard reproductive hen of ZL chicken at 20 week of age**

Household	Number of hen at the end of period (hen)	Number of standard reproductive hen (hen)	Rate of standard reproductive hen (%)
Thanh Hoa	1.395	1.314	94,19
Quang Ninh	1.384	1.316	95,09
Bac Giang	1.404	1.327	94,52

### 3.4.1.3. Body weight and egg weight of hybrid hen ZL at 5%, 30%, 50% and 38 week of age

**Table 3.21. Body weight and egg weight of hybrid hen ZL at 5%, 30%, 50% and 38 week of age**

Items	Age	Thanh Hoa	Quang Ninh	Bac Giang
Body weight (g) n= 60	Laying rate 5 %	1.865,67	1.834,67	1.846,11
	Laying rate 30 %	1.932,00	1.895,83	1.895,65
	Laying rate 50 %	1.942,00	1.905,81	1.937,95
	38 week of age	1.952,33	1.932,24	1950,42
Egg weight (g) n= 90	Laying rate 5 % (n=30)	49,77	49,73	49,38
	Laying rate 30 %	50,32	50,30	51,33
	Laying rate 50 %	53,88	53,57	53,23
	38 week of age	55,07	54,28	54,22

The result of body weight at laying rate 5%,30%, 50% and 38 week of age is showed in table 3.21. Body weight of hen is relatively uniform. At laying rate 5%, body weight reaches

1,834.67 – 1,865.67 g. The body weight increases continuously at laying rate 30% and 50%, however it is not the same. At 38 week of age, body weight is 1,932.24 – 1,952.33 g.

Egg weight at households increases gradually from laying rate 5%. At 38 week of age, egg weight reaches 54.22 – 55.05 g and it is quite uniform between households.

#### 3.4.1.4. Laying rate, egg production and feed consumption per 10 eggs of ZL hybrid chicken

**Table 3.22. Laying rate of ZL hybrid chicken from 21-72 week of age (Unit: %)**

Period (week of age)	Thanh Hoa	Quang Ninh	Bac Giang
21-24	19,69	16,93	19,51
25-28	52,01	50,32	53,65
29-32	64,55	66,87	70,93
33-36	58,31	60,38	61,58
37-40	57,53	56,44	56,85
41-44	58,17	57,65	55,83
45-48	58,21	56,62	56,79
49-52	57,15	55,51	54,54
53-56	54,10	55,29	52,32
57-60	52,48	53,73	52,03
61-64	43,65	47,26	44,29
65-68	37,76	37,39	36,20
69-72	28,00	21,31	28,79
<b>Average</b>	<b>49,35</b>	<b>48,90</b>	<b>49,48</b>

**Table 3.23. Egg production and feed consumption per 10 eggs of ZL hybrid chicken**

Period (week of age)	Thanh Hoa		Quang Ninh		Bac Giang	
	Egg production/hen (egg)	Feed consumption/10 eggs (kg)	Egg production/hen (egg)	Feed consumption/10 eggs (kg)	Egg production/he n(egg)	Feed consumption/10 eggs (kg)
21-24	5,51	5,94	4,74	7,10	5,46	6,02
25-28	14,56	2,30	14,09	2,48	15,02	2,26
29-32	18,07	1,94	18,72	1,89	19,86	1,77
33-36	16,33	2,16	16,91	2,09	17,24	2,06
37-40	16,11	2,20	15,80	2,24	15,92	2,23
41-44	16,29	2,16	16,14	2,18	15,63	2,27
45-48	16,30	2,16	15,85	2,16	15,90	2,23
49-52	16,00	2,20	15,54	2,16	15,27	2,30
53-56	15,15	2,30	15,48	2,15	14,65	2,34
57-60	14,69	2,30	15,04	2,22	14,57	2,30
61-64	12,22	2,67	13,23	2,53	12,40	2,62
65-68	10,57	3,00	10,47	3,21	10,14	3,15
69-72	7,84	3,59	5,97	5,65	8,06	3,87
<b>21-72</b>	<b>179,65</b>	<b>2,46</b>	<b>177,99</b>	<b>2,50</b>	<b>180,12</b>	<b>2,46</b>

The result of laying rate, egg production and feed consumption per 10 eggs from 21-72 week of age raised at households shows in table 3.22 and 3.23. The egg production/hen at Households in Bac Giang is the highest (180.12 eggs). The egg production/hen at Households in Thanh Hoa and Quang Ninh is 180.12 eggs and 177.99 eggs respectively. Feed consumption/10 eggs of three households is from 2.46 to 2.50 kg.

### 3.4.1.5. Breeding egg rate, hatching result and efficiency of raising ZL hybrid hens in the household

Breeding egg rate and hatching result of hen from 30 to 40 week of age shows in table 3.24. Breeding egg rate at household in Bac Giang is the highest (93.3%). Breeding egg rate at household in Quang Ninh is the lowest (91.6%). The percentage of eggs with embryos reaches from 93.2-94.6%. The proportion of first type chickens/total hatching eggs is 81.9% at household in the Bac Giang, 81.5% at household in the Thanh Hoa and 80.3% at household in the Quang Ninh.

**Table 3.24. Hatching result of ZL hybrid hen**

Items	Unit	Thanh Hoa	Quang Ninh	Bac Giang
Breeding egg rate	%	92,4	91,6	93,3
Total number of incubated egg	egg	18.000	18.000	18.000
Number of incubation groups		4	4	4
Rate of egg with embryo	%	94,2	93,2	94,6
Rate of first type egg/total incubated eggs	%	81,5	80,3	81,9

Results of evaluating the effectiveness of hybrid hens in households from 1 day old to 72 weeks of age are shown in Table 3.25. Raising one ZL hybrid hen for breeding gives the lowest income in Quang Ninh (174,414 VND); Bac Giang is 195,906 VND and the highest in Thanh Hoa is 206,605 VND.

**Table 3.25. Efficiency of breeding ZL hybrid hens from 1 day old to 72 weeks old**

Items	Unit	Thanh Hoa	Quang Ninh	Bac Giang
<b>1. Expense</b>	<b>VND/hen</b>	<b>630.395</b>	<b>632.786</b>	<b>616.494</b>
- Buying breed chicken	VND/hen	14.000	14.000	14.000
- Total feed consumption from 1 day old to 20 weeks of age	kg/hen	8,73	8,72	8,71
- Feed price	VND/hen	11.500	11.200	11.600
- Total feed cost from 1 day old to 20 weeks of age	VND/hen	100.395	97.664	101.036
- Feed price	VND/kg	10.000	10.300	9.800
- Total feed consumption from 21 to 72 weeks of age	kg/hen	44,18	44,54	44,31
- Total feed cost from 21 to 72 weeks of age	VND/hen	441.800	458.762	434.238
- Electricity, water, cheap things	VND/hen	15.000	12.000	13.000
- Veterinary cost	VND/hen	20.000	19.000	19.500
- Labor cost	VND/hen	39.200	31.360	34.720
<b>2. Income</b>	<b>VND/hen</b>	<b>837.000</b>	<b>807.200</b>	<b>812.400</b>
- Total breeding eggs/hen	egg	166	163	168
- Breeding egg price	VND/egg	4.500	4.400	4.300
- Income from breeding eggs	VND/hen	747.000	717.200	722.400
- Income from spent hens: 2,0kg/hen x 45.000 VND/kg	VND/hen	90.000	90.000	90.000
<b>3. Income/hen to 72 weeks of age</b>	<b>VND/hen</b>	<b>206.605</b>	<b>174.414</b>	<b>195.906</b>



Thus, through the above results, the experimental breeding of ZL hybrid hens in 3 provinces of Thanh Hoa, Quang Ninh and Bac Giang shows that the results of study are quite similar among the households. Chickens have a high survival rate (95.65-96.96%); egg yield reached 179.65-180.12 eggs/hen/72 weeks of age and feed consumption/10 eggs is from 2.46-2.50 kg; the ratio embryos is 93.2 -94.6%; hatching rate of first type chickens/total hatched eggs is 80.3 - 81.9%. The results are equivalent to those in the experiment. The raising hens in households has high economic efficiency.

### **3.4.2. The results of trail raising three hybrid broiler RZL and LTZL in households**

#### **3.4.2.1. Production ability, yield, meat quality of three hybrid broiler RZL and LTZL**

Production ability, yield, meat quality of three hybrid broiler RZL and LTZL (RZL 500 chickens, LTZL 500 chickens) were raised semi scavenging raising in households in Yen The – Bac Giang for 16 weeks of age is showed in table 3.26 and 3.27. Survival rate to 16 week of age is quite high which is 96.4% of RZL and 96.0% of LTZL chicken. Feed consumption per kg body weight gain of RZL chicken is 3.6kg and that of LTZL is 3.56kg. This result at household in Bac Giang is not significantly higher than that of RZL and LTZL chicken keeping in Mountainous Animal Research and Development Center, Thai Nguyen (3.5kg of RZL and 3.52 kg of LTZL chicken).

**Table 3.26. Production ability and meat production of three hybrid chicken**

<b>Order</b>	<b>Items</b>	<b>Unit</b>	<b>RZL chicken</b>	<b>LTZL chicken</b>
1	Number of chickens at the beginning	con	500	500
2	Number of chickens at the end	con	482	480
3	Survival rate to 16 week of age	%	96,4	96,0
4	Body weight to 16 week of age	g	1.996,6	1.864,6
5	Feed consumption/kg body weight gain	kg	3,6	3,56
6	Carcass rate (n = 6)	%	75,2	72,5
7	Thigh meat rate (n = 6)	%	19,8	18,8
8	Breast meat rate (n = 6)	%	16,2	15,7
9	Belly fat rate (n = 6)	%	0,51	0,27

The results show that the carcass percentage, thigh meat percentage and breast meat percentage of RZL chickens are higher than that of LTZL chicken. The meat quality parameters such as pH 15 minutes, pH 24 hours, brightness, redness, rate of processing dehydration and meat toughness are all in the group of good quality chicken meat. This proves that chickens raised at households has high quality meat which is very suitable for consumers' tastes.

**Table 3.27. Meat quality of three hybrid chicken (n=3)**

Order	Items	Unit	RZL chicken		LTZL chicken	
			Thigh meat	Breast meat	Thigh meat	Breast meat
1	Dry matter	%	23,20	25,34	23,36	25,12
2	Total Protein	%	22,05	25,06	22,13	25,02
3	Total Lipid	%	2,53	0,52	3,02	0,57
4	Total mineral	%	1,25	1,31	1,20	1,36
5	pH 15 minute		6,12	6,01	6,18	6,04
6	pH 24 hour		6,08	6,11	6,13	6,12
7	Brightness L*		51,39	52,00	51,76	51,22
8	Redness a*		17,14	17,21	17,31	17,90
9	Yellowness b*		14,16	14,67	14,79	14,91
10	Processing dehydration rate	%	26,02	26,11	25,62	25,28
11	Meat toughness	Newton	27,75	28,41	27,80	27,70

**3.4.2.2. The efficiency of raising three hybrid chicken RZL and LTZL****Table 3.28. The efficiency of raising three hybrid chicken in households**

Order	Items	Unit	RZL chicken	Gà LTZL chicken
1	Number of chickens at the beginning	chicken	500	500
2	Number of chickens at the end	chicken	482	480
3	Beed chicken cost	VND	6.750.000	6.750.000
4	Feed cost	VND	33.948.535	31.279.700
5	Vaccine cost ( <i>Marek, pox disease, Gumboro, bird flu, Newcastle, IB</i> )	VND	1.250.000	1.250.000
6	Veterinary medicine cost	VND	101.846	93.839
7	Electricity, water and cheap things	VND	1.357.941	1.251.188
8	Total cost	VND	43.408.322	40.624.727
9	Production cost for 1 kg live chicken weight		45.123	45.391
10	Chicken selling price	VND /kg	60.000	60.000
11	Total of live body weight sold	kg	962	895
12	Income from selling	VND	57.720.000	53.700.000
13	Income - expenses	VND	14.311.678	13.075.273
<b>14</b>	<b>Income from raising one broiler</b>	<b>VND/chicken</b>	<b>28.623</b>	<b>26.151</b>

Evaluation of the efficiency of raising commercial chickens of 3 hybrid chicken at households (Table 3.28) after 16 weeks of age. The income of raising 500 RZL chickens is 14,311,678 VND. The income of raising 500 LTZL chickens is 13,075,273 VND. If calculated on 1 chicken, raising RZL chickens earns 28,623 VND/chicken and LTZL chickens earns 26,151 VND/chicken. Compared to other types of chicken raised in Yen The at the same time, the income is higher 20% compared Mia crossbreed chicken and higher 10% compared fighting crossbreed chicken.

Thus, in trials of 500 RZL and 500 LTZL crossbred chickens at households in Bac Giang up to 16 weeks of age, the survival rate was 96.4% and 96.0%; body weight 1,966.6g and 1,864.6g; Feed consumption/kg weight gain is 3.60 kg and 3.56 kg. Income from raising 1 broiler chicken is 28,623 VND and 26,151 VND.

## **CONCLUSION AND RECOMMENDATION**

### **1. CONCLUSION**

**1.1.** Two Hybrid hen ZL has higher production and lower feed consumption than LZ chicken. Therefore, ZL hybrid hen has been selected as the base breeding hen to crossbreeding . The ZL chicken at 20 week of age has uniform yellow-spotted brown feathers, single crest, white earlobe; body weight is 1,825.56g; egg yield/hen at 52 weeks of laying is 180.02 eggs with 3.48% heterosis, food consumption/10 eggs is 2.59kg with -4.62% heterosis. The egg weight is 54.67g and embryo rate 95.36%. The hatching rate of first type chickens/total hatched eggs is 81.59%.

**1.2.** Three hybrid chicken RZL and LTZL with diverse feather color, medium body size, 100% cocks and hens with flag crest, yellow skin, yellow legs and yellow beak; up to 16 weeks of age, chicken achieves a high survival rate (94-95%); body weight reaches 1,911.33g and 1,888.75g respectively, higher than Ri chicken (1,524.08g) and LT chicken (1,700.50g) by 25.4% and 11.07%. The feed consumption/ a kg weight gain is 3.50kg and 3.52kg. RZL and LTZL chicken have higher meat yield than Ri chicken and Lac Thuy chicken. Meat quality parameters: amino acid composition in meat, pH, brightness, redness, toughness and dehydration rate of preservation and processing are equivalent to Ri, Lac Thuy chicken and are in the range of high quality chicken.

**1.3.** The hybrid chicken ZL raised in households in Thanh Hoa, Quang Ninh, Bac Giang and commercial crossbred chickens of 3 varieties RZL and LTZL raised in households in Bac Giang achieved similar results as in the study: ZL crossbred hens had the suitable body weight for starting laying. The egg yield/hen/72 weeks of age reached 177.99-180.12 eggs. The feed consumption/10 eggs reached 2.47kg and the three hybrid chicken RZL and LTZL up to 16 weeks of age achieved survival rate of 96.4% and 96.0%. The body weight was 1,966.6g and 1,864.6g. The feed consumption/kg weight gain was 3.60kg and 3.56kg.

### **2. RECOMMENDATION**

Developing and expanding to raise the two hybrid chicken ZL and three hybrid chicken RZL and LTZL in the production.