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Performance and resilience of poultry in Thailand

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Abstract

The layer chicken industry is an important sector of livestock production in Thailand because of its link to household income generation, employment generation and foreign exchange earnings. Exportation of eggs and egg product generates over 1,170 million of Thai baht ($AU 39 million) foreign income annually after 2009. However, outbreaks of exotic diseases through the importation of exotic strains of poultry had negative economic impacts on the industry. This has forced the egg industry of Thailand to develop a sustainable layer industry based on breeds and strains that have high survival rate under the harsh climatic conditions in Thailand and simultaneously maintain commercially viable productivity. Rhode Island Red (RIR) and White Plymouth Rock (WPR) breeds were imported in 1944 and maintained under existing poultry management conditions in Thailand, having been identified as the prime genetic resources to build a sustainable poultry industry in Thailand. Since 2004, a structured genetic improvement programme has been implemented to improve the productivity of these two breeds and their crosses, while maintaining a high survival rate (>90%) under the existing backyard poultry management conditions in Thailand. Preliminary analyses reveal that the performances of the newly developed strains, especially for egg production, were similar to that of the exotic breeds in Thailand. Survivability under tropical poultry management conditions is a trait that describes resilience of laying hens. The survival rate of the newly developed strains under backyard poultry management conditions in Thailand were 97.5%. This survival rate of the newly developed strains was higher than the survival rates of indigenous chicken under similar conditions. This implies that the newly developed strains could reduce over reliance on the importation of commercial layer birds and thereby, reduce the risk of introducing exotic poultry diseases which jeopardise the sustainability of poultry production in Thailand.

Introduction

The layer chicken industry is an important sector of livestock production in Thailand, because of its links to household income and employment generation as well as foreign exchange earnings. In order to achieve the above objectives, the industry has traditionally relied on the importation of parents as well as commercial day-old chicks. This importation of day-old chicks and other poultry products carries substantial risks of introducing diseases from the importing countries. One such incident was the major outbreak of Avian Influenza (AI) infection in 2004. This outbreak of AI resulted in an economic loss of $AU 357 million to the Thai poultry in-

dustry as the results of banning of imported and exported chicks, egg and egg products (Avian Influenza Control Centre, 2006). Therefore, there is a need to develop a resilient poultry industry which could reduce risks such as those associated with exotic diseases to sustain the poultry industry in Thailand. This paper identifies the importance of the layer poultry industry in Thailand and the approach used by the Government of Thailand to improve its sustainability and resilience.

The layer chicken industry in Thailand

Until 1924, backyard poultry systems were the predominant style of poultry management in Thailand. Commercial poultry production was initiated in 1949. Consumer demand for large eggs with brown shell colour and red egg yolk prompted the importation of the Rhode Island Red and White Plymouth Rock breeds from United States. Crossbred layer chickens from the above two breeds were introduced in 1951 to increase the survival and productivity of the backyard poultry in Thailand.

Table 1 highlights the growth of the poultry sector over the ten-year period starting in 2003. Layer farms constitute 2% of all poultry farms in Thailand and housed 14% of the total poultry population in Thailand (Information Technology Centre, 2013). The fluctuation in the chicken population from 2004 to 2010 was due to AI outbreaks from 2004 to 2008 and implementation of AI control measures, such as ban on the importation and exportation of poultry and poultry products in those years. However, in 2012, there were 50,911 egg producing farms in Thailand, and they housed 54 million laying hens. Farmer training programmes were introduced in 2008 and they have improved the management skills of the poultry farmers in Thailand. This, in turn, increased the application of modern technologies in routine management of poultry flocks. As a result, the egg production in Thailand has increased by 3.6% per year. Currently, the farmers in Thailand produce about 37 million eggs per day. The majority (95%) of the eggs produced in Thailand are used for local consumption and the rest are exported.

Table 1. Chicken population in Thailand from 2003 to 2012

Year	Chicken type			Total (million)
	Broiler (million)	Layer (million)	Native (million)	
2003	165	24	63	252
2004	102	21	56	179
2005	148	41	65	254
2006	100	30	54	184
2007	170	50	63	283
2008	137	41	57	235
2009	174	46	62	282
2010	151	44	71	266
2011	189	52	76	317
2012	248	54	82	384

Source: Information Technology Centre (2013)

Economic returns from export of poultry products

The export of eggs and egg products generate valuable foreign income for Thailand. Thailand exports 80 to 90% of all exports of poultry products to Hong Kong and the rest to Africa. Major export products are egg shell, egg liquid, yolk liquid, egg powder and albumin powder. The income generated from export of eggs and egg products from Thailand are shown in Table 2. The foreign income earned by exporting eggs and egg products increased significantly from 2005 to 2009 (Table 2). In 2009, the total foreign exchange earned by exporting egg and egg product was over $AU 39 million.

Table 2. Import expenses and export revenues in Thai baht ($AU in parentheses) of layer products from 2005 to 2009

Year	Import	Export	Balance
2005	191 m (6.4 m)	385 m (12.8 m)	+194 m (6.5 m)
2006	198 m (6.6 m)	490 m (16.3 m)	+688 m (22.9 m)
2007	252 m (8.4 m)	952 m (31.7 m)	+700 m (23.3 m)
2008	182 m (6.1 m)	1,164 m (38.8 m)	+982 m (32.7 m)
2009	134 m (4.5 m)	1,174 m (39.1 m)	+1,040 m (34.7 m)

Source: Information Technology Centre (2013)

Economic losses due to exotic diseases

The growth of the poultry industry generates high demands for parents and commercial chicks. In the past, these demands were fulfilled by importing day-old chicks from other countries. However, the importation of day-old chicks increased the risk of introducing exotic poultry diseases to Thailand. The outbreak of Avian Influenza disease (AI) in 2004 was the notable outcome of this importation of day-old chicks from other countries. The ban on the importation and exportation of chicks and poultry products during the outbreak imposed a severe cost to the poultry producers in Thailand because of loss of production and reduction in the exportation of eggs and egg products. The losses incurred by different sectors of the poultry industry is summarised in Table 3. The total losses incurred by the industry amounted to more than $AU 3,350 million. These losses demonstrated the need to develop a sustainable poultry production system to protect the industry from exotic diseases.

Table 3. Economic losses in Thai baht ($AU in parentheses) due to Avian Influenza outbreak in 2004

Industry sector	Loss value	
Poultry feed processing	12,430 m	(414 m)
Parents and commercial day-old chick producers	4,420 m	(147 m)
Commercial poultry producers	27,950 m	(932 m)
Slaughter house owners	28,400 m	(947 m)
Export of poultry products	27,500 m	(917 m)
Total	100,700 m	(3,357 m)

Source: Avian Influenza Control Centre (2006)

Breeding to reduce the influence of exotic diseases

In order to develop a sustainable poultry production system for the commercial, as well as, for the backyard poultry industry, the Department of Livestock Development in Thailand initiated a genetic improvement program of poultry in 2004. Rhode Island Red (RIR) and White Plymouth Rock (WPR) lines were established from the imported breeds but managed under local conditions for over 60 years, and a commercial crossbreeding program was initiated in 2004. The RIR and WPR were crossed with imported brown egg laying commercial chickens (COM) and two crossbred lines, RIR x COM (RC) and WPR x COM (WC), were established. The RIR and RC are designated as male lines and the WPR and WC are designated as female lines. Crossbred chicken from the WC and RC cross are called the DLD chicken and they are being issued to commercial layer farmers in Thailand. The day-old chicks produced by crossing the RIR and WPR lines are issued to backyard poultry producers.

Within-line selection is applied in all four lines (RIR, WPR, RC and WC) to improve the productivity of the crossbred chicken. About 200 laying hens and 40 males per year are maintained in each line. The replacement birds in each line are selected based on a selection index, using age at first egg (AFE), body weight at first egg (BFE) and egg weight at first egg (WFE), number of eggs produced during the first 120 days of lay (EGG) and average egg weight at 17 weeks of lay (EWT). The same selection index is applied to all four lines. This means there is no differential selection emphasis for the males and female lines or for the commercial and the backyard chicken lines. This is mainly due to lack of estimated genetic parameters for the different poultry lines. Genetic parameters for economically important traits in four established lines were estimated by Tongsiri *et al*. (2014). Estimated heritability for EGG, EWT, AFE, BFE and WFE of RIR hens were 0.33, 0.47, 0.46, 0.51 and 0.28, for WPR were 0.30, 0.43, 0.44, 0.41 and 0.33 respectively. Similar estimates were obtained for RC and WC hens demonstrating moderate to high heritability estimates for all four lines (unpublished). The newly estimated genetic parameters will be used to develop appropriate genetic selection indexes for each of the four establishes lines.

Performance of newly developed strains

Performances of the newly developed RIR, WPR and their crosses for commercial and backyard poultry were compared with the performance of a popular brown egg laying commercial strain. Table 4 gives the summary of performances of the pure lines, crossbred lines and the commercial brown egg laying strains for five economically important egg production traits. Both RIR and WPR laid about 100 eggs (at the rate of 85%) for the first 17 weeks of their laying period and they reached sexual maturity at 24 weeks of age. Average egg weight of RIR and WPR was about 50g.

The crossbred chicken from the pure lines for commercial (RC x WC) and backyard poultry (RIR x WPR) production laid similar number of eggs for the first 17 weeks of their lay as hens from the two pure lines and reached sexual maturity about a weeks earlier than the hens from the pure lines. Except for AFE and EWT, the newly developed RIR and WPR lines and their crosses were performing on par with some of the exotic commercial brown egg laying strains. On 2007, imported commercial strains under intensive management reached sexual maturity five weeks earlier and laid about 30 eggs more than the newly developed crossbred chicken. However, implementation of appropriate selection index for each line and selection for early maturity and higher egg production in the female lines are expected to improve the performances of the birds from the pure lines and their crosses.

Table 4. Egg production performances of Rhode Island Red (RIR), White Plymouth Rock (WPR), their commercial cross (RC x WC), backyard cross (RIR x WPR) and a popular brown egg laying commercial strain (COM)

Trait	RIR	WPR	RIR x WPR	RC x WC	COM
Egg production for the first 17 weeks of lay	103.0	101.2	100.0	103.0	101.0
Average egg weight at 17 weeks of lay, g	52.0	50.5	56.0	60.0	62.5
Age at first egg, days	169.4	174.0	159.0	169.0	133.0
Body weight at first egg, kg	1.7	1.6	1.9	1.7	1.5
Egg weight at first egg, g	41.4	38.5	41.0	44.0	45.0

Source: Bureau of Animal Husbandry and Genetic Improvement (2007)

Survivability of newly developed strains

Survivability under tropical poultry management conditions is a trait that describes resilience of laying hens. Therefore, survivability during laying period is the key factor in the development of new lines and their crosses using locally adapted breeds. The average survival rate of the newly developed crossbred layer chicken (RIR x WPR) was compared with that of indigenous layer chickens under popular 200 hen-housed back yard poultry production system (Table 5). The average survival rate during first three months of lay of crossbred layers and the indigenous chicken were 97.5% and 94.9%, respectively. In a similar study conducted by Department of Livestock Development in 2007, the survival rate of laying hens from the RC x WC crossing was 97%. Exotic commercial strains are not managed under the backyard poultry production system in Thailand. Therefore, their survival rate was not compared with that of the newly developed strains. However, their survival rate is expected be equal or lower than that of indigenous chicken. Information about survivability of poultry under tropical management conditions is limited. However, the survival rates of the newly developed crossbred chicken under the backyard poultry keeping was higher than survival rate of 82.5% reported by Barua *et al*. (1998) for the crossbred birds of RIR and local chicken in Bangladesh. The RIR and WPR are being managed under tropical conditions for last the 60 years and this is reflected in their higher survival rates. The result of this study undoubtedly shows that the newly bred crossbred chicken are well adapted to the rural and tropical conditions in Thailand.

Table 5. Average survival rate (%) of crossbred layer chicken and indigenous chicken under 200 hen-housed backyard poultry production system in Thailand

Hen age (in week)	RIR x WPR crosses	Indigenous chicken
22	100.0	98.5
23	100.0	97.5
24	100.0	97.0
25	99.7	96.0
26	98.2	96.0
27	97.0	94.5
28	96.7	94.5
29	96.5	94.0
30	96.2	94.0
31	95.7	93.0
32	95.7	92.5
33	95.0	92.0
Average	97.5	94.9

Source: Bureau of Animal Husbandry and Genetic Improvement (2007)

Conclusions

The layer chicken industry is an important sector of livestock production in Thailand because of its link to household income generation, employment generation and foreign exchange earnings. Therefore, the poultry industry needs to be resilient to external threats such as the outbreak of exotic diseases. Newly developed layers strains have the ability to survive under the backyard poultry condition in a tropical environment, while performing equally to some of the imported commercial strains. This will provide the resilience required for a sustainable poultry production in Thailand.

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