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# Effects of *Pandanus amaryllifolius* Roxb. Supplementation on Egg Production Performance and Egg Quality Under Different Housing Systems

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## ABSTRACT

A 2 × 2 factorial completely randomized design was conducted to study the effects of *Pandanus amaryllifolius* Roxb. supplementation under two types of housing system on the egg production performance and egg quality of laying hens. Three hundred-twenty Hisex Brown layers aged about 25 weeks were randomly divided into four groups each with eight replications. The animals in each replicate were randomly fed with a laying-hen diet supplemented with either 0 or 5 g per hen per day of fresh *P. amaryllifolius* Roxb. and were kept in an evaporative cooling house versus in an open house. The daily egg production was collected over four periods with 28 d per period and the eggs from the last 3 d in each period were collected to measure egg quality. The results showed that the egg production, daily feed intake and egg quality, in terms of egg weight and eggshell thickness, of laying hens kept in the evaporative cooling house were significantly better than those of hens raised under the open house system ($P< 0.01$). Nevertheless, supplementation with *P. amaryllifolius* Roxb. in the diet significantly improved the egg production ($P< 0.01$), whereas the daily feed intake of the hens was also likely to be increased ($P = 0.06$). The egg production of laying hens kept in the open house system could be improved by about 11% through the supplementation with 5 g per hen per day of *P. amaryllifolius* Roxb. in the diet, which had no significant effect on the egg production of hens kept in the evaporative cooling house.


**Key words:** layer diet, *Pandanus amaryllifolius* Roxb., closed house, open house, evaporative cooling house

## INTRODUCTION

Nowadays, commercial egg production is focused on the yield and the productive efficiency of the laying hens. Therefore, housing a high density of hens is popular and this seems to cause weakness and susceptibility to diseases and the environment among the hens (Mountney and Parkhurst, 1995; Thorp and Luiting, 2000). Moreover, the use of antibiotics for disease prevention is also strictly controlled, because of concerns about residues in animal products and food safety issues for consumers. Consequently, several alternative strategies have been applied to improve the production and egg qualities, especially in the open house system, such as feed additive supplementation, including herbs and plant extracts to increase the nutrient utilization, immune enhancement and improve the microfloral balance. P. *amaryllifolius* Roxb. is one of the

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popular plants that is usually used for several purposes in humans, such as acceleration of urine excretion, relief of thirst, heart nourishment and refreshment (Pongbunrod, 1976; Thiangburanatham, 1988; Temsirikritkul, 1993; Krishnapun, 1995; Suchawon, 1997). The effective ingredients of *P. amaryllifolius* Roxb. can be divided into two groups: one with aromatic substances and the other with chlorophyll (Krishnapun, 1995). The aromatic substances, such as linalil acetate, benzyl acetate, linalool, geranoil, coumarin and ethyl vanillin, were reported as appetite enhancers, whereas chlorophyll, including its derivatives, had a positive effect on metabolic processes, red blood cell formation and hormonal function (Chanpreechakul and Wattanakitrungrote, 2000). Thus, this experiment was conducted to study the opportunity to use the beneficial medicinal properties of *P. amaryllifolius* Roxb. to improve egg production performance and the egg quality of laying hens kept in an open house that was exposed to environmental stress.

## MATERIALS AND METHODS

Three hundred-twenty Hisex Brown laying hens, aged about 25-26 weeks, were used in a 2 × 2 factorial completely randomized design experiment. The effects of two levels of supplementation of *P. amaryllifolius* Roxb. (0 and 5 g per hen per day) and two types of housing system (evaporative cooling house and open housing) on egg production and egg quality were studied. The animals were divided into four groups with eight replications. Each replicate consisted of ten animals and randomly received one of the following treatments:

Treatment 1: fed with a diet without supplementation and kept in open housing (control group).

Treatment 2: fed with a diet supplemented with 5 g per hen per day of fresh *P. amaryllifolius* Roxb. and kept in open housing.

Treatment 3: fed with a diet without supplementation and kept in housing with evaporative cooling.

Treatment 4: fed with a diet supplemented with 5 g per hen per day of fresh *P. amaryllifolius* Roxb. and kept in housing with evaporative cooling.

The diet used in this study was calculated to have sufficient nutrient components to meet the recommended standard for laying hens (National Research Council, 1994). The animals were individually kept in cages, where water was provided *ad libitum*. Twice-a-day feeding was provided and fresh *P. amaryllifolius* Roxb. was added to the diet and fed to the animals only in the morning. The daily egg production, as well as the feed intake, was recorded over four periods with 28 d in each period. Additionally, the eggs from the last 3 d in each period were collected to study the egg quality in terms of egg weight, specific gravity, shell thickness, yolk color and Haugh unit (Roush, 1981).

All collected data were statistically analyzed using analysis of variance (ANOVA) and the means from each group were compared by the Tukey method (Hanmongkolpipat, 2002).

## RESULTS AND DISCUSSION

### Egg production performance

Table 1 shows the effects of dietary supplementation of fresh *P. amaryllifolius* Roxb. on the productive performance of laying hens raised in different types of housing system. The livability and the average daily feed intake of laying hens were not significantly affected, whereas the egg production was significantly improved ($P< 0.01$) by *P. amaryllifolius* Roxb. supplementation. The chlorophyll and its derivatives may have improved the metabolism and enhanced nutrient utilization (Chanpreechapul and Wattanakitrungrote, 2000). In addition, the aromatic substances in *P. amaryllifolius* Roxb.,

such as linalool, coumarin and ethyl vanillin, may have helped stimulate the feed intake of the hens, although the difference was not significant (P = 0.06).

The productive performance of the laying hens was strongly affected (P< 0.0001) by the different type of housing system. It was found that the average daily feed intake, percentage of livability, as well as the egg production of the laying hens house with the evaporative cooling, where the temperature and humidity were stable and controlled, were significantly improved, when compared with the productive performance of hens raised under the open house system. The fluctuating temperature during the day and night, as well as the high humidity during the experimental period, could have affected the feed intake and consequently the egg production decreased for hens in the open house system. Pequri and Coon (1991) reported that at 32°C, a decrease in feed intake of laying hens resulted from the heat effect on their anterior hypothalamic area. North and Bell (1990) also reported that the feed intake of laying hens decreased by about 50% when the temperature increased from 21.1 to 37.8°C and egg production, as well as fertility, also decreased at 38°C.

Furthermore, an interaction between the *P. amaryllifolius* Roxb. supplementation and the type of housing system was found. Table 1 shows that the livability and daily feed intake of laying hens raised in housing with evaporative cooling were significantly better than those of laying hens raised under the open house system, even without supplementation with *P. amaryllifolius* Roxb.. Egg production followed the same trend. Nevertheless, supplementation with 5 g per hen per day of fresh *P. amaryllifolius* Roxb. in the diet reduced the heat effect on the productive performance. The egg production of laying hens kept in the open house system was significantly improved (P< 0.0001), when compared with that of those in the non-supplemented group. It can be noted that the beneficial medicinal ingredients in

**Table 1** Effects of fresh *P. amaryllifolius* Roxb. supplementation on egg production performance of laying hens raised in different types of housing system.

| | Livability (%) | Daily feed intake (gm./d) | Egg production (%) |
|---|---|---|---|
| Non-supplemented group | 97.02 | 108.19 | 80.84[b] |
| Supplemented with *P. amaryllifolius* Roxb. | 97.10 | 109.42 | 84.60[a] |
| P-value | 0.4631 | 0.0689 | 0.0001 |
| Opened house system | 95.32[b] | 102.83[b] | 77.81[b] |
| Evaporative cooling house system | 98.79[a] | 114.77[a] | 87.63[a] |
| P-value | < 0.0001 | < 0.0001 | < 0.0001 |
| -Non-supplemented in opened house | 95.85[b] | 101.43[b] | 73.73[b] |
| -*P. amaryllifolius Roxb*. supplementation in open house | 94.80[b] | 104.24[b] | 81.89[a] |
| -Non-supplemented in evaporative cooling house | 98.18[a] | 114.94[a] | 87.95[a] |
| -*P. amaryllifolius Roxb*. supplementation in evaporative house | 99.40[a] | 114.60[a] | 87.31[a] |
| P-value | 0.0029 | 0.0204 | 0.0001 |
| Pool SE ± | 5.89 | 10.66 | 9.17 |

[a,b]: means within same column with different superscripts are significantly different for each factor.

*P. amaryllifolius* Roxb. could improve feed utilization and reduce the stress effect.

**Egg qualities**

The effects of *P. amaryllifolius* Roxb. supplementation on the egg quality of laying hens kept in different types of housing system are shown in Table 2. Egg quality parameters, such as egg weight, yolk color, specific gravity, eggshell thickness and Haugh unit, were not significantly affected by the *P. amaryllifolius* Roxb. supplementation, whereas the egg weight and eggshell thickness were significantly affected ($P < 0.01$) by the housing system. The high temperature could have been a factor affecting the reduction of feed intake, the acid-base imbalance and the loss of bicarbonate in the plasma. Consequently, there was insufficient calcium carbonate necessary for satisfactory eggshell formation (Emery *et al*., 1984). Additionally, the reduction of feed intake may have caused lower calcium consumption and the eggshell quality was finally affected (Deaton *et al*., 1982). Supplementation with 5 g per hen per day of fresh *P. amaryllifolius* Roxb. did not significantly improve the egg weight and the eggshell thickness of the laying hens kept in the open house system.

## CONCLUSION

Supplementation with 5 g per hen per day of fresh *P. amaryllifolius* Roxb. in the diet of laying hens could significantly improve ($P < 0.01$) egg production and the livability percentage of laying hens kept in an open house system, whereas significant improvement in the egg quality was not found in this experiment. The productive performance and the egg quality of laying hens kept in housing with evaporative cooling were not affected by the *P. amaryllifolius* Roxb. supplementation.

**Table 2** Effects of fresh *P. amaryllifolius* Roxb. supplementation on egg quality of laying hens raised in different types of housing system.

| | Egg weight (gm.) | Yolk colour | Specific gravity | Shell thickness | Haugh unit |
|---|---|---|---|---|---|
| Non-supplemented group | 58.57 | 11.56 | 1.093 | 0.314 | 81.56 |
| Supplemented with *P. amaryllifolius* Roxb. | 58.41 | 11.63 | 1.094 | 0.317 | 81.34 |
| P-value | 0.4975 | 0.6788 | 0.2405 | 0.768 | 0.9166 |
| Open house system | 57.25[b] | 11.49 | 1.094 | 0.298[b] | 80.14 |
| Evaporative cooling house system | 59.74[a] | 11.75 | 1.094 | 0.342[a] | 83.38 |
| P-value | <0.0001 | 0.1117 | 0.7079 | <0.0001 | 0.1234 |
| -Non-supplemented in opened house | 57.58[b] | 11.50 | 1.093 | 0.296 | 79.76 |
| -*P. amaryllifolius Roxb*. supplementation in open house | 56.91[b] | 11.48 | 1.094 | 0.299 | 80.52 |
| -Non-supplemented in evaporative cooling house | 59.56[a] | 11.66 | 1.093 | 0.341 | 84.26 |
| -*P. amaryllifolius Roxb*. supplementation in evaporative house | 59.91[a] | 11.85 | 1.095 | 0.343 | 82.54 |
| P-value | 0.0299 | 0.5192 | 0.9253 | 0.5192 | 0.5549 |
| Pool SE ± | 3.66 | 1.03 | 0.005 | 0.95 | 13.05 |

[a,b]: means within same column with different superscripts are significantly different for each factor.

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