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Office: Room 902, 9th Floor, VUSTA Building Lot D20, Alley 19, Duy Tan, Dich Vong Hau, Cau Giay, Hanoi.

Tel / Fax: +84.24.38691511

Hotline: +84.986422026 / +84.913340186

E.mail: tapchichannuoi@hoichannuoi.vn

Website: www.hoichannuoi.vn

Account:

Name: Hội Chăn nuôi Việt Nam (AHAV)

Number: 1300 311 0000 40, in AgriBank, Thăng Long, 4, Phạm Ngọc Thạch, Hà Nội

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SCIENTIFIC NEWS

EFFECT OF HERBAL PRODUCTS SUMPPLEMENTATION ON PRODUCTIVITY PERFORMANCES OF COMMERCIAL FROG PRODUCTION UNDER FIELD CONDITION

Le Thi Ngoc Han[1], Ngo Duc Thien[2], Nguyen Dinh Toan[1], Nguyen Phu Hoa[2], Amr El-Sayed[3], Nguyen Van Duc[4] and Nguyen Ngoc Tan[5]*

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ABSTRACT

The objective of this study was to initially evaluate the effect of herbal product supplementation in the ration on the performances of commercial frog production in field condition at Dong Thap province of Vietnam. Two trials have been carried out to evaluate the supplementation of Herb-1 (Herb-All™LIVER) and/or Herb-2 (Herb-All™PARA-X) at the farm condition with different scales. At the experimental scale, the results showed that the final weight (kg/cage) was the highest (P<0.05) in the Herb-1 group (109.73 kg/cage), followed by the control or combined Herb-1 and Herb-2 group (96.98 or 97.18 kg/cage, respectively) and the lowest value was found in the Herb-2 group (94.12 kg/cage). The weight gain was higher (P<0.05) in the Herb-1 group (101.22 kg/cage), with a similar value found in the control or combined Herb products (88.20 or 88.90 kg/cage), and the lowest value in the Herb-2 group (85.43 kg/cage). The FCR value was reduced by 10 or 17% in the combined Herb-1+Herb-2 group or Herb-1 group compared to the control group. Under practical conditions, the final weight in the control, Herb-1, Herb-2 or combined herbs group was 470.63, 544.60, 460.21 or 471.82 kg/cage, respectively. A significant difference (P<0.05) was found in Herb-1 or combined Herb-1+Herb-2 compared to other treatments. The FCR value was reduced by 15% in the Herb-1 group or by 8% in the combined Herb-1+Herb-2 group compared to the control group. Taken together, we conclude that Herb products could serve as novel natural feed additive in commercial frog cultivation as they can improve growth performance and feed efficiency of commercial frogs. However, the optimal concentrations and how to combine the two kinds of Herb products require further studies.

Keywords: *Amphibian, aquaculture, commercial frog culture, herbal, growth.*

1. INTRODUCTION

Freshwater aquaculture is one of the most important and fastest-growing food-producing industries worldwide, it plays an important role as an alternative source of cheap animal protein, and is also considered as an important sector that can create job opportunities for poor communities (Mbokane and Moyo, 2022). In Dong Thap province, frog cultivation is developing as an important sector in aquaculture. The regular model of culture is a cage in pond combined with Tra fish, rarely cage in ditch as Thailand's frog culture system (Kamatit *et al*., 2023), and intensive frog production system is generally applied by local farmers. In the current practical circumstance, frogs are normal grown in high density and may face many problems such as stress, limited space, inadequate diet, cannibalism, predators, and poor water quality (Zhang *et al*., 2015). Thus, good management of frog diet and health should be attained. Aquaculture growth is often linked to culture intensification, leading to overcrowding (high density) and poor water quality, facilitating the spread of pathogens and increasing disease outbreaks and mortality (Bondad-Reantaso *et al*., 2005). To avoid economic losses related to sanitary shortcomings, veterinary drugs are commonly used in aquaculture to prevent and treat disease outbreaks (Rico *et al*., 2013). The intensive use of synthetic drugs presents numerous disadvantages, for both the environment and public health. Intensive use

[1] EASTVET company, Vietnam
[2] Nong Lam University - Ho Chi Minh City, Vietnam
[3] Cairo University, Egypt
[4] Animal Husbandry Association of Vietnam
* Corresponding Author: Assoc. Prof. Dr. Ngoc Tan Nguyen, Faculty of Biological Sciences, Nong Lam University - Ho Chi Minh City. Tel: 0948993338. Email: nntan@hcmuaf.edu.vn.

of antibiotics has resulted in accumulation in muscle of commercialized animals (Cabello *et al*., 2006; Romero-Ormazabal *et al*., 2012) and the development of resistant bacteria strains (Miranda and Zemelman, 2002; Seyfried *et al*., 2010). Beside this, the use of antiparasitic drugs like trichlorfon or praziquantel in bath treatments is hazardous for animals and the environment and can also result in the development of resistance (Umeda *et al*., 2006; Forwood *et al*., 2013). This knowledge leads researchers to find novel feed additives obtained from plants or other natural products (Citarasu, 2010; Duzmic and Blache, 2012; Reverter *et al*., 2014). Herbal ingredients are natural ingredients derived from plants, which are containing the flavonoid, polyphenol/tannins, glucosides, alkaloid, etheric oils, saponin, biter substances, vitamin, protein and etc., for use in medicine. The results of scientific studies on the benefits of herbal ingredients have been widely carried out in fish cultivation and used as standard operating procedures for cultivation (Nurjanah *et al*., 2023). However, the use of herbs in frog culture has not been widely practiced, therefore, this study aimed to evaluate the effect of Herb products supplementation on the growth of commercial frog in the field condition.

2. MATERIALS AND METHODS

2.1. Animals and feeding

Frog rearing conditions: Crossbred frogs with an initial weight of 4-5 g/froglet were obtained from a local supplier at My An Town, Thap Muoi District, Dong Thap province. They were randomly allocated in a cage ($2\times4m^2$ or $2\times4\times1m^3$) on an experimental scale or ($4\times10m^2$; $4\times10\times1m^3$) for practical conditions, a completely randomized design using 4 treatments and 3 replications. Each replication was about 2,000 froglets/cage in the experimental scale or 10,000 froglets/cage in the practical field. This investigation was performed during the hot season of Southern Vietnam (from Feb to June, 2024)

Feeding ration: The basal diets were obtained from the commercial feed company containing not less than 30% crude protein and 4% lipid. Two kinds of Herbs were used and added to the basal diets and mixed together by using a binder.

Ingredients of Herb All products: Herb-1 (Herb-All™LIVER): *Andrographis paniculata, Tinospora cordifolia* & Nut Fiber. Herb-2 (Herb-All™PARA-X): *Curcuma longa rhizome, Allium sativum* & Nut Fiber.

2.2. Experimental designs

2.2.1. Preliminary trial with experimental scale

In this trial, four treatments were set up and the frogs were raised in the cage with 2x4x1 m^3 including control group (basal diet without any herbal supplementation), treatment group with Herb-1 (basal diet with 0.02% of Herb-1), treatment group with Herb-2 (basal diet with 0.02% of Herb-2) and treatment group with combined Herb-1 and Herb-2 (basal diet with 0.02% of each Herb-1 and Herb-2).

2.2.2. Expanded trial with practiced condition scale

The experimental design was similar to the article 2.2.1, except the frogs were raised in a cage with ($4\times10\times1$ m^3).

2.2.3 Evaluation of growth parameters, feed conversion rate and economic efficacy

At the end of the treatment period, frogs were fasted for at least 12hrs. Growth parameters were evaluated by using following equations:

- Weight gain (WG) = final frog weight (kg/cage) – initial frog weight (kg/cage).
- Feed conversion ratio (FCR) = feed intake (kg/cage)/weight gain (kg/cage).
- Economic efficacy: Total costs consist of the fee for certain investments such as: buying froglets, commercial feed, labor and additive materials, herb

products. Total revenue was only the income by selling the frog at the end of trials, the unit was VND.

2.3. Data analysis

To obtain the mean and standard error of the mean, the descriptive statistics was applied. All obtained data were subjected to one way ANOVA followed by Tukey's test (Minitab) for comparison, percentage data were transformed to arsine before subjecting to analysis. Data are presented as mean ± SEM, and significance level was set at P<0.05.

3. RESULTS AND DISCUSSION

3.1. Effect of Herb supplementation on productivity performances of commercial frog under the experimental scale

We initially started with the trial at experimental condition, collected data from the trial to analyze the effect of Herb products that supplemented at single or combined dose of each Herb on the growth parameters, the data were analyzed and presented in Table 1.

Table 1. Effect of Herb products on the growth of commercial frog production in under experimental scale

Parameters	Control	Herb-1 (0.02%)	Herb-2 (0.02%)	Herb-1+Herb-2 (0.02:0.02)
Initial weight (kg/cage)	8.78±0.04	8.52±0.22	8.68±0.18	8.28±0.04
Final weight (kg/cage)	96.98^{ab}±0.81	109.73^{b}±4.94	94.12^{a}±2.31	97.18^{ab}±1.24
Weight gain (kg/cage)	88.20^{a}±0.80	101.22^{b}±4.76	85.43^{a}±2.14	88.90^{a}±1.26
FCR (kg of Feed /kg weight gain)	1.60^{b}±0.06	1.40^{a}±0.02	1.65^{b}±0.06	1.59^{b}±0.07
FCR (compared to control; times)	1	0.83	1.01	0.90

Cage: 2m×4m. Within row, the mean with different superscript differs (P<0.05), data are presented as mean±SEM of 3 replicates

As shown in table 1, the initial weight of froglets per cage was 8.28 to 8.78 kg/cage (P>0.05), the final weight (kg/cage) was 109.73 kg/cage in Herb-1 group, then lower in Control or combined Herb-1 and Herb-2 group (96.98 or 97.18 kg/cage, respectively) and the lowest value was found in Herb-2 group (94.12 kg/cage), a significant difference was only found between Herb-1 and Herb-2 group (P<0.05). After 65 days of culture, the weight gain was higher (P<0.05) in Herb-1 group (101.22 kg/cage) and similar value was found in the control or combined Herb products (88.20 or 88.90 kg/cage), and the lower value was in the Herb-2 group (85.43 kg/cage). The FCR value was lowest in Herb-1 group (1.40) then higher in combined Herbs group (1.59) and highest in control or para group (1.60 or 1.65, respectively), a significant difference between Herb-1 and other groups was found. The FCR was reduced by 17% in the Herb-1 group or by 10% in the combined herbs group as compared to the control group.

The economic analysis was performed, and the results as shown in Table 2.

Table 2. Effect of Herb products on economic efficiency of commercial frog production under experimental scale

Parameters	Control	Herb-1 (0.02%)	Herb-2 (0.02%)	Herb-1+Herb-2 (0.02:0.02)
Total cost (VND/cage)	3,637,096.78	3,660,159.12	3,673,520.08	3.736.196,83
Total revenue (VND/cage)	4,461,233.33	5,047,733.33	4,329,366.67	4.470.433,33
Benefit (VND/cage)	824.136,55	1,387,574.21	655,846.58	734.236,51
Compared to control (times)	1	1.68	0.80	0.89

Cage: 2m×4m = 8m², data are presented as mean from three replicates

Data from table 2 indicated that the benefit was significant higher in Herb-1 group (VND 1,387,572.21) as compared to control (VND 824.136.55) or combined herbs group (VND 734.236,51) and the lowest benefit value was found in Herb-2 group (VND 655.846,58). Interestingly, the benefit value increased about 1.68 times when added to Herb-1 as compared to the control.

3.2. Effect of Herb supplementation on productivity performances of commercial frog under the field condition

In the practical field trial (40 m² per cage), four treatments were set up similar to the experimental scale, the data were collected and analyzed, the results of growth performances are presented in table 3.

Table 3. Effect of Herb products on the growth of commercial frog production under practical field

Parameters	Farm	Control	Herb-1 (0.02%)	Herb-2 (0.02%)	Herb-1+Herb-2 (0.02:0.02)
Initial weight (kg/cage)	*Farm 1*	*39.93±0.48*	*39.77±0.64*	*39.49±0.46*	*39.60±0.55*
	Farm 2	*37.58±0.41*	*38.06±0.17*	*37.52±0.33*	*38.15±0.28*
	Overall	38.59±0.55	38.79±0.43	38.36±0.47	38.77±0.39
Final weight (kg/cage)	*Farm 1*	*474.96±31.21*	*549.50±5.04*	*468.07±14.70*	*511.17±10.44*
	Farm 2	*467.38^{ab}±13.82*	*540.93^{a}±14.98*	*454.33^{b}±9.28*	*510.16^{ab}±33.24*
	Overall	470.63^{bc}±14.00	544.60^{a}±8.41	460.21^{c}±7.95	510.59^{ab}±18.20
Weight gain (kg/cage)	*Farm 1*	*435.03±31.42*	*509.73±5.48*	*428.57±14.95*	*471.56±10.80*
	Farm 2	*429.80^{ab}±13.69*	*502.86^{a}±15.01*	*416.81^{b}±9.26*	*472.01^{ab}±33.41*
	Overall	432.04^{b}±13.99	505.81^{a}±8.40	421.85^{b}±7.88	471.82^{ab}±18.32
FCR (kg of Feed /kg weight gain)	*Farm 1*	*1.74±0.06*	*1.44±0.02*	*1.75±0.06*	*1.57±0.07*
	Farm 2	*1.59^{a}±0.04*	*1.37^{b}±0.03*	*1.67^{a}±0.03*	*1.47^{ab}±0.09*
	Overall	1.65^{a}±0.07	1.40^{b}±0.02	1.70^{a}±0.04	1.52^{ab}±0.06
FCR compared to control (times)	*Farm 1*	*1*	*0.83*	*1.01*	*0.90*
	Farm 2	*1*	*0.86*	*1.05*	*0.93*
	Overall	1	0.85	1.03	0.92

Cage: 4m×10m = 40m². Within the row, the mean with different superscripts differs (P<0.05), data are presented as Mean±SEM from three replicates in farm 1, four replicates in farm 2 and 7 replicates in overall.

Data in Table 3 indicated that the initial weight ranged 39.49 to 39.93 kg/cage in farm 1 and 37.52 to 38.79 kg/cage in farm 2 or 38.36 to 38.79 kg/cage in overall, no significant difference among treatments was observed in farm 1 or farm 2.

For final weight, the highest value was obtained in Herb-1 group of farm 1 and farm 2 (549.50 and 540.93 kg/cage, respectively), lower value in combined herbs group (511.15 and 510.16 kg/cage, respectively in farm 1 and 2), then lowest value was found in control (474.96 and 467.38 kg/cage) or Herb-2 (468.07 and 454.33 kg/cage) group in both farms. The trend of positive effect of Herb-1 on final weight was found (P=0.07) in farm 1, and a significant difference was found between Herb-1 group and Control or herb-2 groups (P<0.05) in farm 2. In overall, the final weight in control, Herb-1, Herb-2 or combined herbs was 470.63, 544.60, 460.21 or 510.59 kg/cage, a significant difference (P<0.05) was found in Herb-1 group or combined herbs as compared to other treatments.

For weight gain, the trend of data were similar to the final weight obtained in above that indicated in Table 3. Taking all data, we speculate that Herb-2 seems not effective in commercial frogs that are raised under an uncontrolled water environment.

The FCR value, in overall, was lowest in Herb-1 group (1.40), higher in combined Herb-1+Herb-2 group (1.52), and highest in control or Herb-2 group (1.65 or 1.70), a significant difference only found in Herb-1 as compared to control or Herb-2 group (P<0.05). In overall, the FCR value was reduced 15% in the Herb-1 group or 8% in combined Herb-1+Herb-2 group as compared to control group. In addition, the FCR value in all treatments seems to be high, it could be due to the trials carried out under the hottest conditions of Southern Vietnam, in parallel with many unknown factors that must be considered.

Several studies reported that the diets containing Herbs significantly increased final weight, weight gain, ADG and reduced FCR value as compared to those of the control

frogs (Kamatid *et al*., 2016) or fish (Reverter *et al*., 2014; Arief *et al*., 2015; Nurjanah *et al*., 2023) indicating that Herbs could be used as feed additive in aquatic feeds to promote productivity. The growth promotion observed in the current investigation could be attributed to the actions of alkaloids, flavonoids, phenolics or saponins, etc… contained in herb products used.

The economic analysis was performed, and the results are presented in Table 4.

Table 4. Effect of Herb products on economic efficiency of commercial frog production under practical field

Parameters	Farm	Control	**Herb-1** (0.02%)	**Herb-2** (0.02%)	**Herb-1+Herb-2** (0.02:0.02)
Total cost (VND/cage)	*Farm 1*	*19.094.124,9*	*19.167.645,9*	*19.427.263,7*	*19.611.055,7*
	Farm 2	*18.004.533,0*	*18.172.200,0*	*18.258.264,7*	*18.153.229,2*
	Overall	18.549.328,9	18.669.923,0	18.842.825,3	18.882.142,4
Total revenue (VND/cage)	*Farm 1*	*21.848.313,3*	*25.277.000,0*	*21.531.066,7*	*23.513.666,7*
	Farm 2	*21.499.250,0*	*24.882.550,0*	*20.898.950,0*	*23.467.475,0*
	Overall	21.673.781,7	25.079.775,0	21.215.008,3	23.490.570,8
Benefit (VND/cage)	*Farm 1*	*2.754.188,4*	*6.109.354,1*	*2.103.803,0*	*3.902.611,0*
	Farm 2	*3.494.717,0*	*6.710.350,0*	*2.640.563,1*	*5.314.245,8*
	Overall	3.124.452,7	6.409.852,0	2.372.183,0	4.608.428,4
Compared to control (times)	*Farm 1*	*1.00*	*2.22*	*0.76*	*1.42*
	Farm 2	*1.00*	*1.92*	*0.76*	*1. 52*
	Overall	1.00	2.05	0.76	1.47

Data are presented as mean from three replicates in farm 1; four replicates in farm 2 and 7 replicates in overall.

Data from table 4 evidenced that the net profit improved 2.05 times added Herb-1 or 1.47 times when combined Herb-1 and Herb-2 in the ration as compared to the control group.

Additionally, the herbal dietary feed supplement method is the best traditional method and is also low-cost, nontoxic, and environmentally friendly (Zhang *et al*., 2015; Vijayaram *et al*., 2023). The herbal dietary feed supplement is an alternative way to enhance healthy commercial frog production in aquaculture.

4. CONCLUSION

Our current study is the first report in Vietnam to indicate that herbs could be used as a novel natural feed additive in commercial frog cultivation, as they can improve growth performance and feed efficiency of commercial frogs. The optimal concentrations and how to combine two kinds of Herb-All™ products require further studies.

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