Evaluation of an integrated fish, ducks and rice system to reduce pollution and improve resource utilization

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INTRODUCTION

- Demand for rice, meat and eggs of ducks and vegetable increasing
- Activities of the traditional duck production are faced with many problems
- The main constraints affecting the free-grazing system today include
  - Time available for ducks scavenge the fields limited, the payments higher
  - The cost of transporting ducks from province to province increased
  - AI disease in the year round with high risks for scavenging ducks
  - Limitation of season, ducks can not scavenge during dry season
- Producers applied integrated duck-fish farming to produce in year round
  - Big problem: wastes mud and water
  - Environment polluted
- A series of trials were caried out to evaluate the integration
  - Fish directly consumed droppings
  - Waste water from the system was drained off and treated in the rice field
  - Mud in the system for growing rice plants
  - Mud for growing water spinach

OBJECTIVES

- To evaluate the integration of duck-fish farming
- Integration of fish directly with droppings
- Waste water treated in the rice field
- Waste mud fertilized dirrectly for growing rice
- Mud dried used for water spinach plants
- Create jobs for laborers and products for market in out off rice season

HYPOTHESIS

- **Fattening ducks could grow well when freely accessed to pond water in the hot season**
- **Coliforms from the waste water could be eliminated in the rice fields under sunlight and rice field conditions.**
- **Mud in the pond could be valued as fertilizer with high ash and nitrogen for rice plants growing.**
- **Dried mud could be an organic fertilizer for growing water spinach to replace inorganic fertilizer in producing safe vegetables**

METHODS AND MATERIALS

- **Experiment 1*: Use of different systems to keep the ducks in controlled conditions in dry season***
- **Experimental design: The trial carried out on a smallholding farm in the Mekong Delta, designed completely randomized with 3 treatments and 3 replicates, ducks balanced in sex.The treatments were:**
  - **Ducks were kept with access to water of the duck-fish integration (DFI)**
  - **The ducks were kept on wire floor over the fish pond (DOW)**
  - **The ducks were in complete confinement on litter (DOL) as a control treatment**

All the ducks were supplied a mash mixtured for growing duckling with 16.5% of protein and 2980 kcak/kg of feed

Experimental ducks kept on wire floor with access to pond water

Ducks kept on wire floor without access to water

Ducks in confinement on litter

METHODS AND MATERIALS

Experiment 2*: Use of wet waste mud and water in the integration pond as fertilizers for growing rice and treatment of pollution*

- **The rice area divided 9 plots separated by clear nylon sheets. There were 3 treatments, 3 replicates randomized. Treatments were:**
  1. **Growing rice area with complete application of chemical fertilizers (CTR)**
  2. **Rice area applied 80% chemical fertilizers of (1) plus waste mud (WAF)**
  3. **Rice area fertilized only waste mud without chemical fertilizer (WNF)**
- **Chemical fertilizers used DAP, NPK & Urea, 250 kg/ha based on experiences**
- **Wet waste mud (30% DM, with 92% ash and 1.7% N in DM) used for rice plots of treatments 2 and 3 after sowing seeds 30 days.**
- **All rice plots were sprayed with pesticides belong to the damages of insect pests (if any) according to the farmers' practice.**
- **The waste water in the pond was pumped into plots of the treatment 2 and 3 to treat microorganisms in the rice field.**
- **The test for total coliforms by MPN (most probable number) method carried out in the laboratory of Cantho university**

Experimental plots on rice plants surrounded by nylon sheets

Waste mud fertilized to growing rice plants in plots

METHODS AND MATERIALS

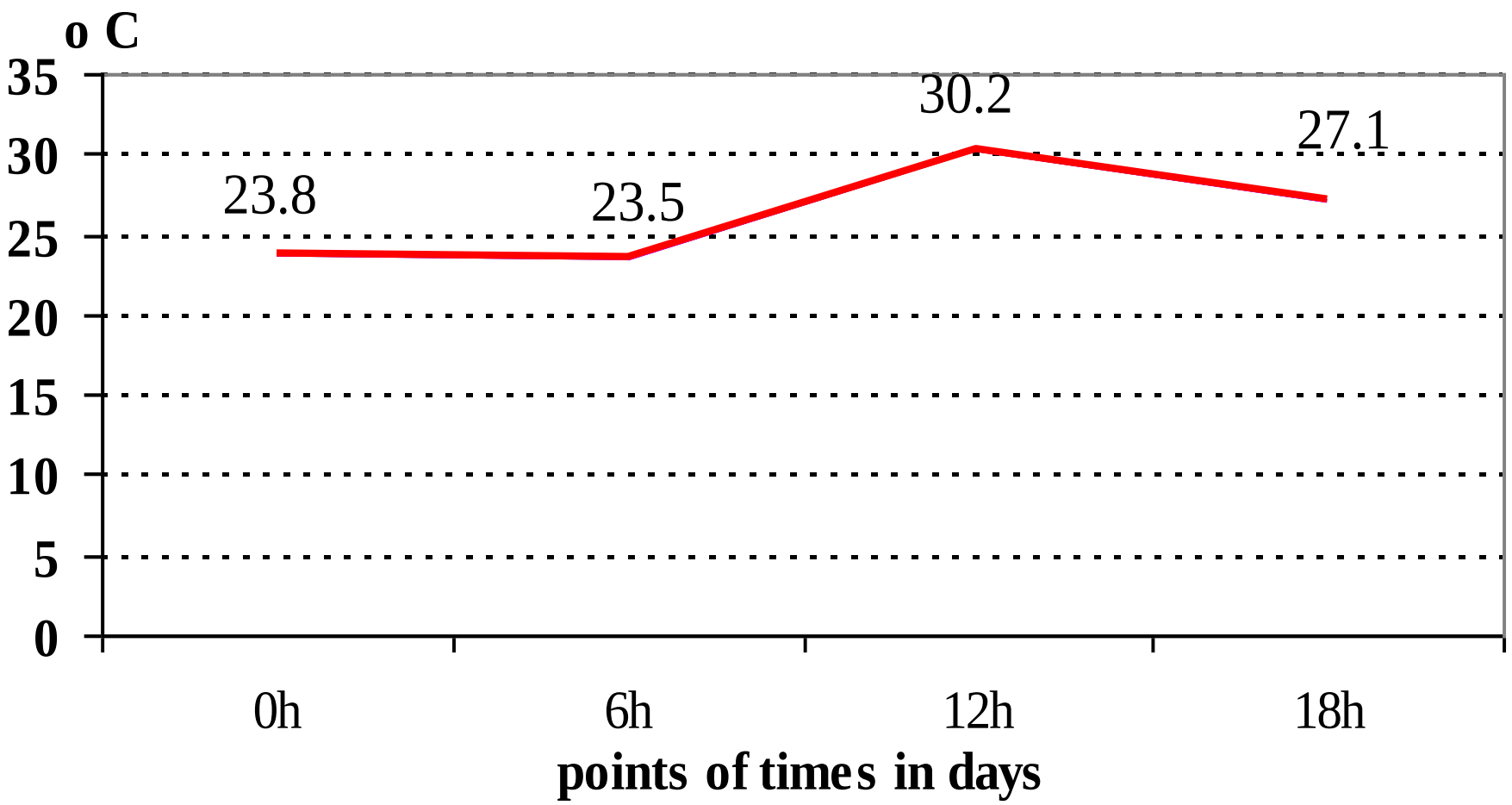
- Experiment 3: ***Use of dried waste mud to plant water spinach***
- **The trial consisted of 3 treatments with 3 replicates. The treatment were:**
  - **1. WS fertilized with fertilizers of DAP, Kali and Urea 61g/m2 (CTRF)**
  - **2. WS with 50% fertilizers of CTRF plus 20 kg dried mud/m2 (M50F)**
  - **3. WS fertilized 40 kg dried mud without chemical fertilizers (MNFS)**
- **The mud was mixed with the soil of the treatment 2 and 3 two weeks before seeding WS.**
- **The chemical fertilizers were mixed with soil in treatment 1**
- **After seeding, the first fertilization was carried out when the plants had 4 true leaves, then once every 5 days, and stopped 10 days before havesting**

Seeding water spinach in experimental plots

After seeding WS seeds covered with old rice straw

RESULTS AND DISCUSSIONS

- Experiment 1***: Effect of different systems on performance of ducks***
- **The trial was carried out in the dry season. average temperatures in housing: 26,2 oC ± 6,4o C, and high at noon, over 30o C**
- **Hester *et al.* (1981) observed a 30% reduction in daily gain of Pekin ducks at 29.4o C compared to at 18.3o C.**
- **Duong Thanh Liem (2008): Environmental temperature is one of factors that influences to appetite and feed consumptions. At 30-35o C decrease appetite and feed intakes of poultry**



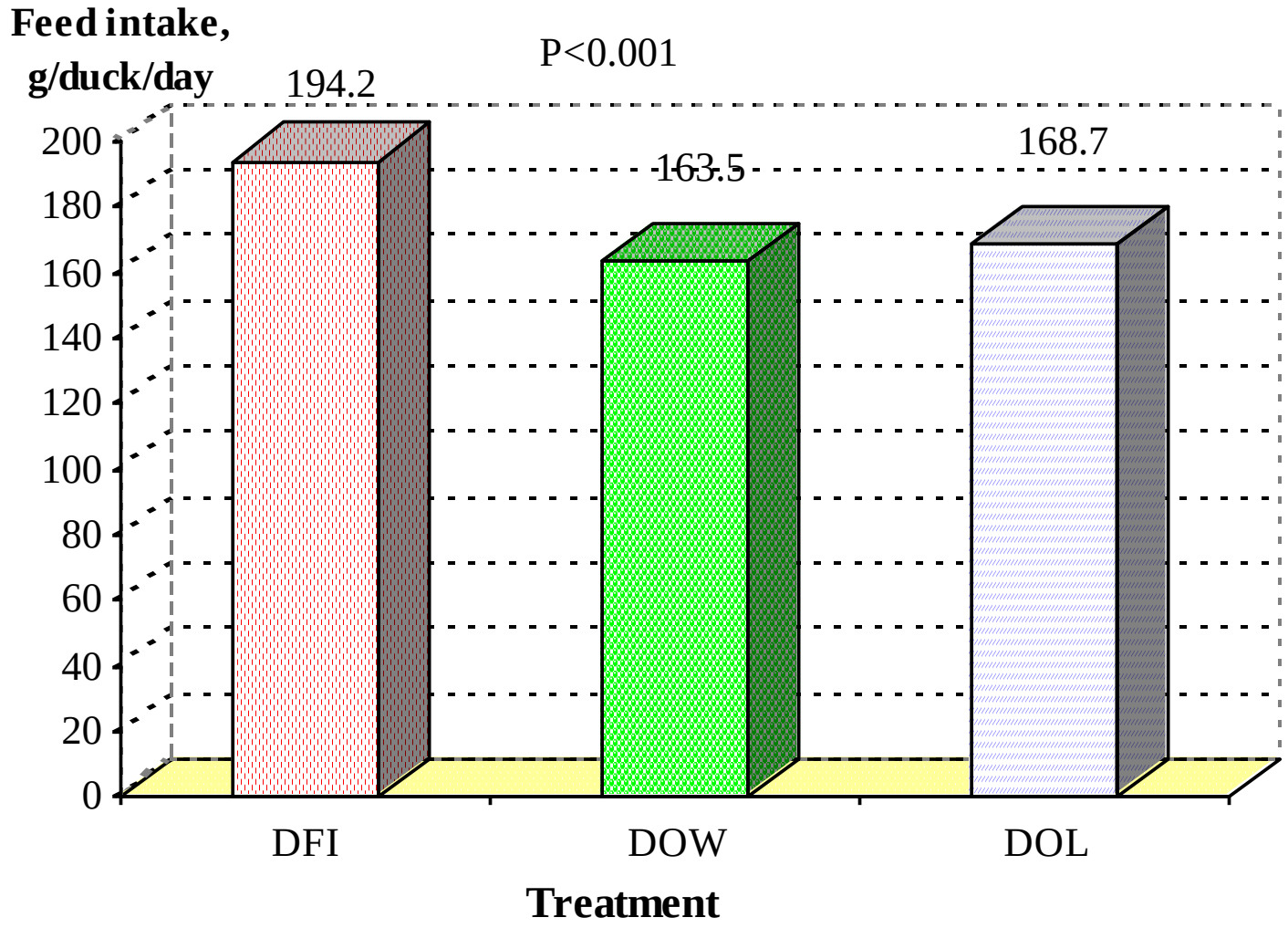
Average temperatures at points in days during the experiment

Feed intakes of ducks

Daily feed intakes of ducks in treatments

Parameter	Treatment			SE	P level
	DFI	DOW	DOL		
Total feed intake, g/duck	1165.2[a]	981.0[a]	1011.9[b*]	13.5	0.001
Daily feed intake, g/duck	194.2[a]	163.5[a]	168.7[b]	10.5	0.011

a,b means without common superscripts within rows are significantly different (p<0.05)



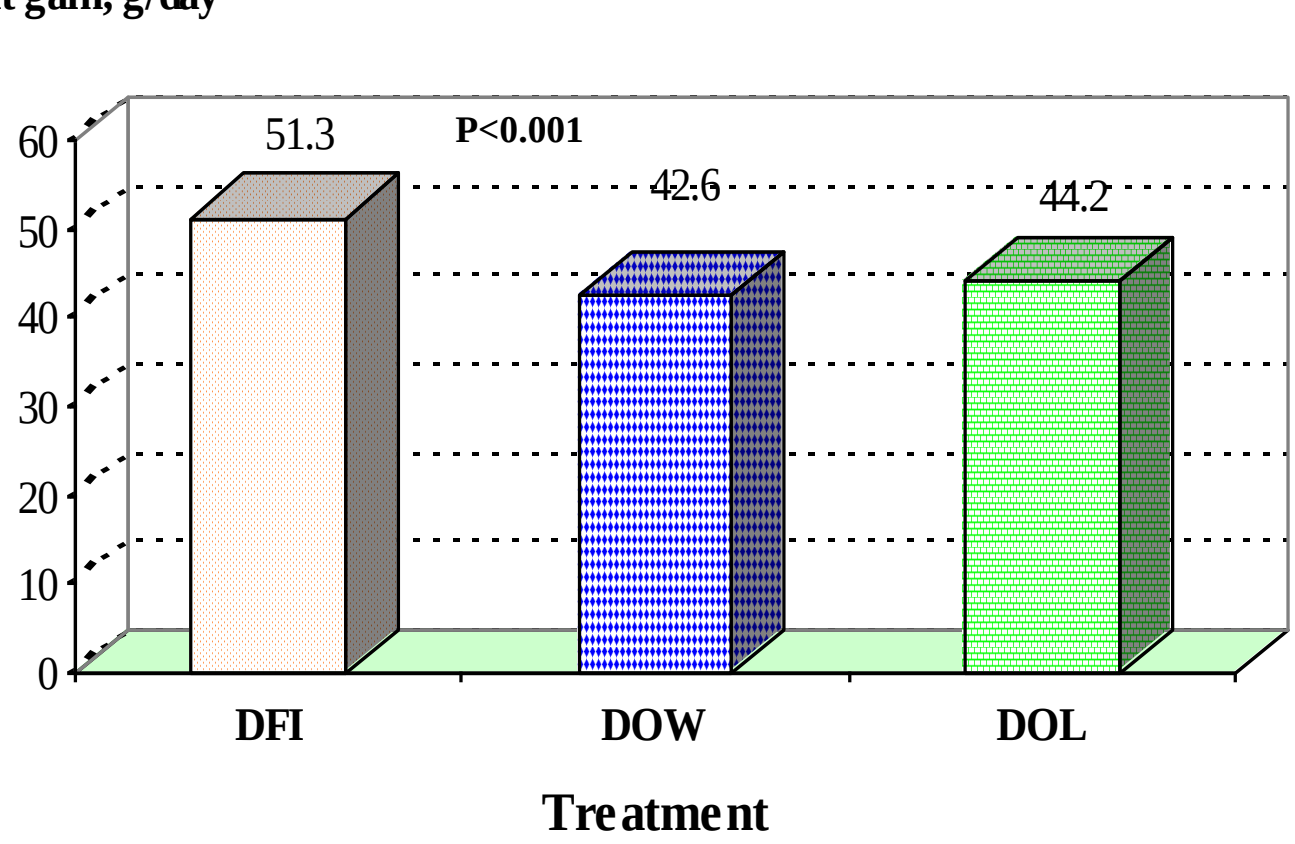
Daily feed intakes of ducks in treatments

PERFORMANCE OF DUCKS

- Table: Effect of systems on daily weight gains and feed conversion

Parameter	DFI	DOW	DOL	SE	P value
Live weight, g					
Initial	645.6	637.2	627.2	2.4	0.102
Final	2421.7[a]	2128.3[b]	2192.2[bc]	7.41	0.001
Daily live weight gain, g	51.3[a]	42.6[b]	44.2[bc]	7.93	0.001
Daily intake, g DM/duck	173.2	145.8	150.4	4.53	0.011
FCR, kg DM/kg gain	3.38	3.41	3.42	0.06	0.882

a,b means without common superscripts within rows are significantly different (p<0.05)



Daily live weight gain of ducks in experimental treatments

BENEFITS BASED GAIN PER DUCK AND FISH GAIN

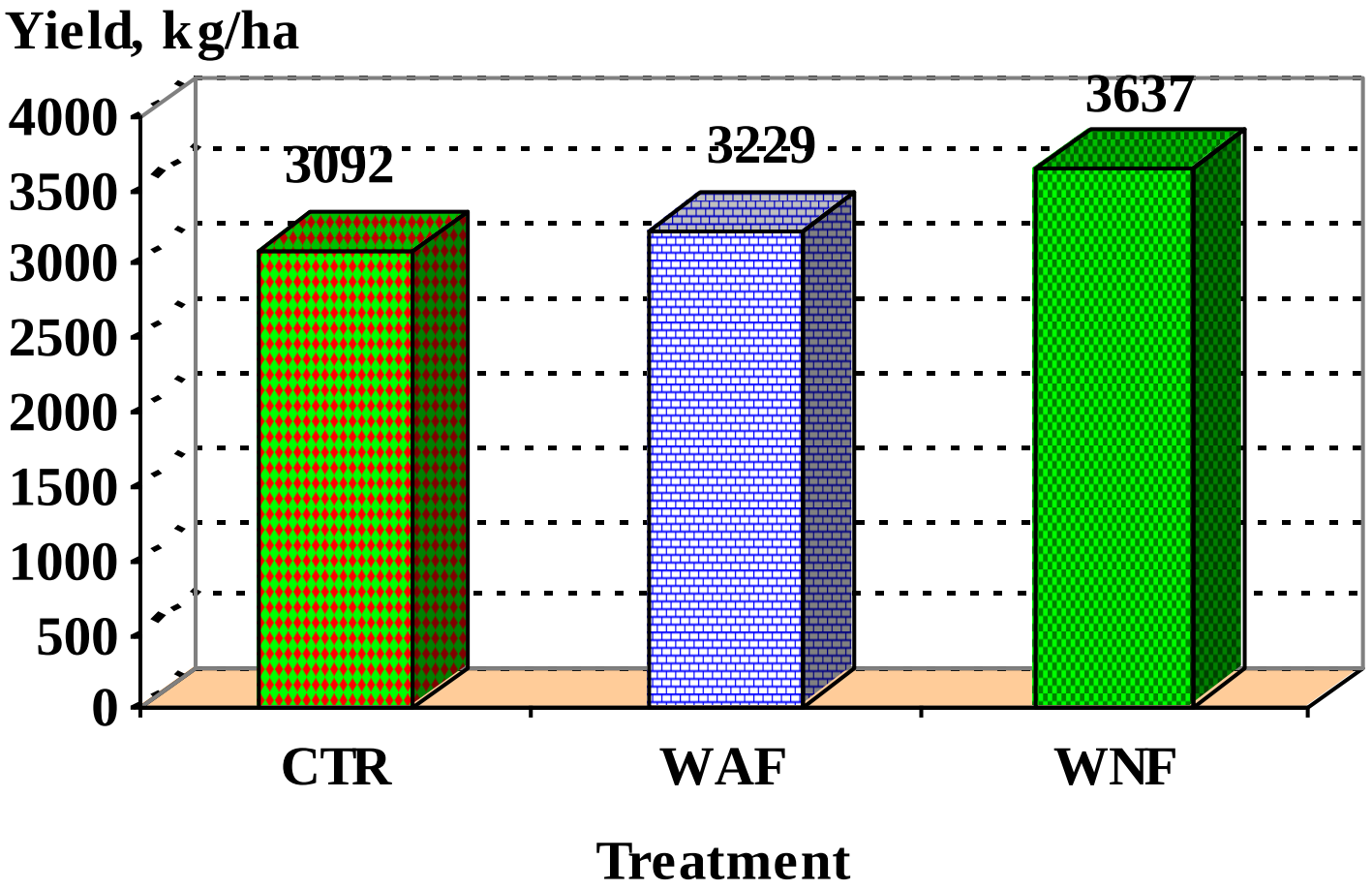
Estimates of benefits based on weight gain per duck and fish gain accompanied

Parameter	DFI	DOW	DOL
Income per duck, VND	50,232	41,784	43,316
Income from fish gain, VND	2,637	3,546	0
Cost of feed per duck, VND	34,742	29,028	30,040
Total benefit per duck and fish	18,397	16,266	13,276
Rate, % of control	139	123	100
	100	93.7	89.8

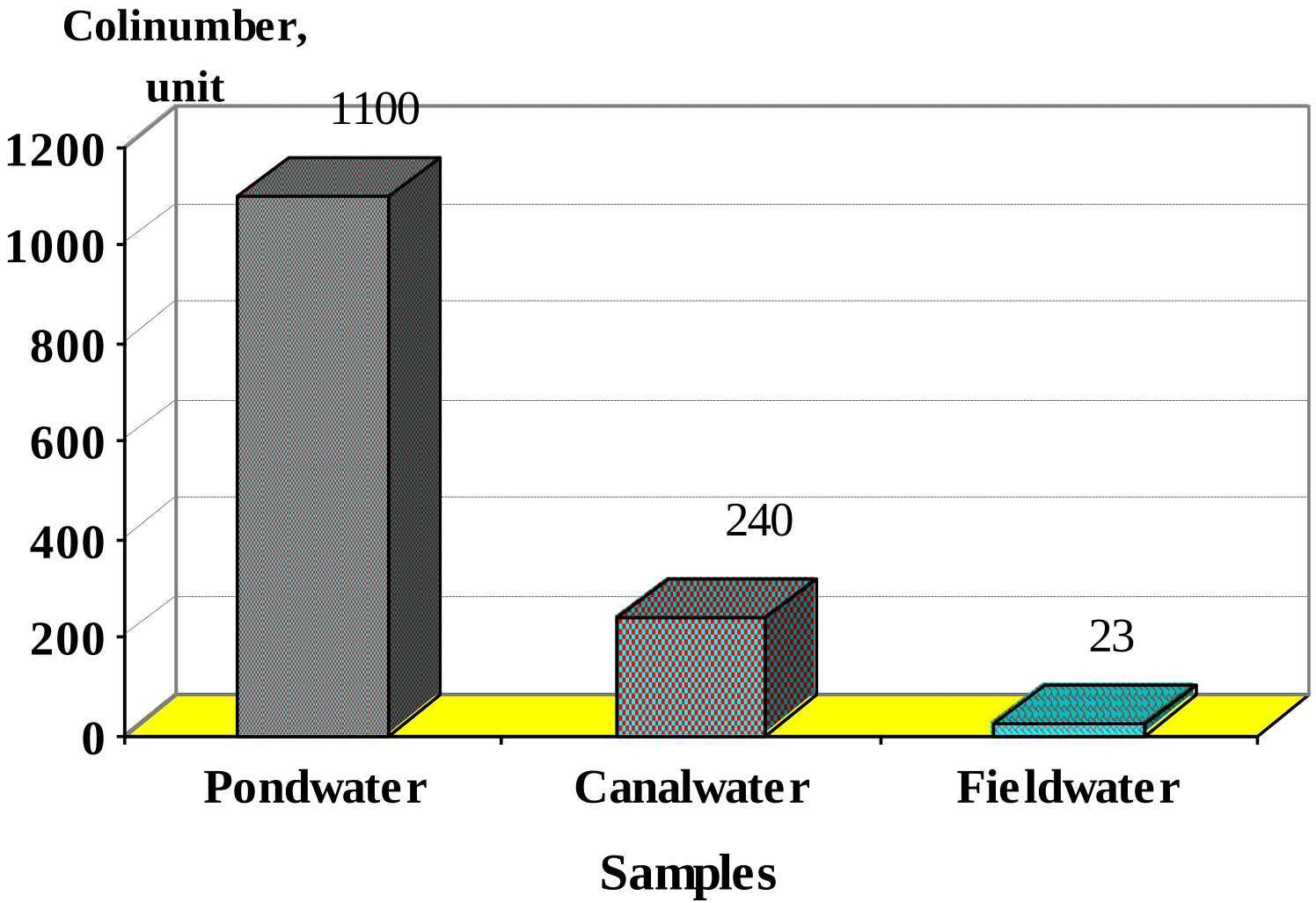
Based on price per kg for maize 4,500, rice bran 2,500 and soya meal 9,000, fish meal 8,000 VND; 16,500 VND=1US$

RESULTS AND DISCUSSIONS

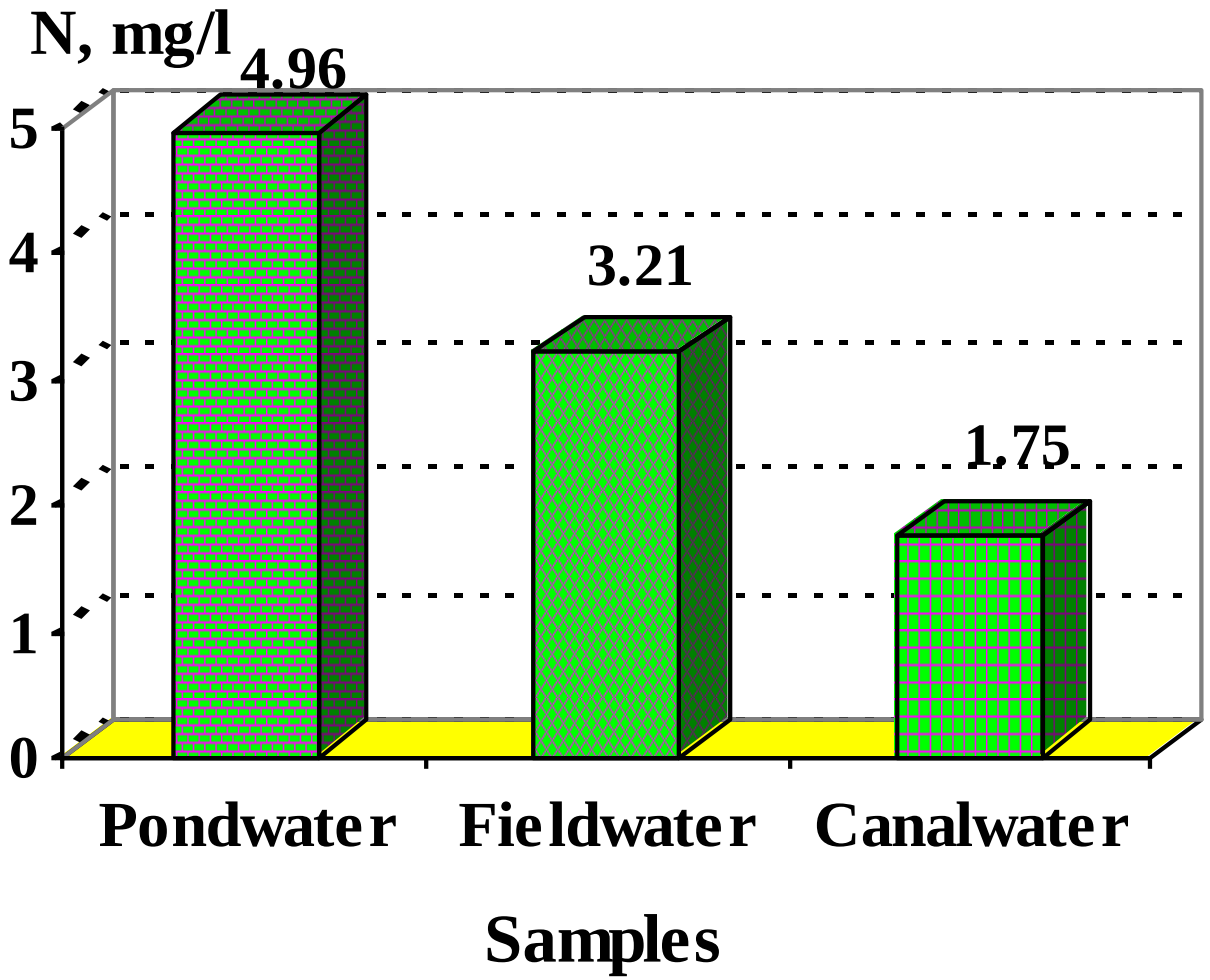
- Experiment 2: ***Waste mud to rice plants and effects of treating waste water in the rice field, rice yields and number of coliforms in water of rice field***



Rice yields in experimental treatments



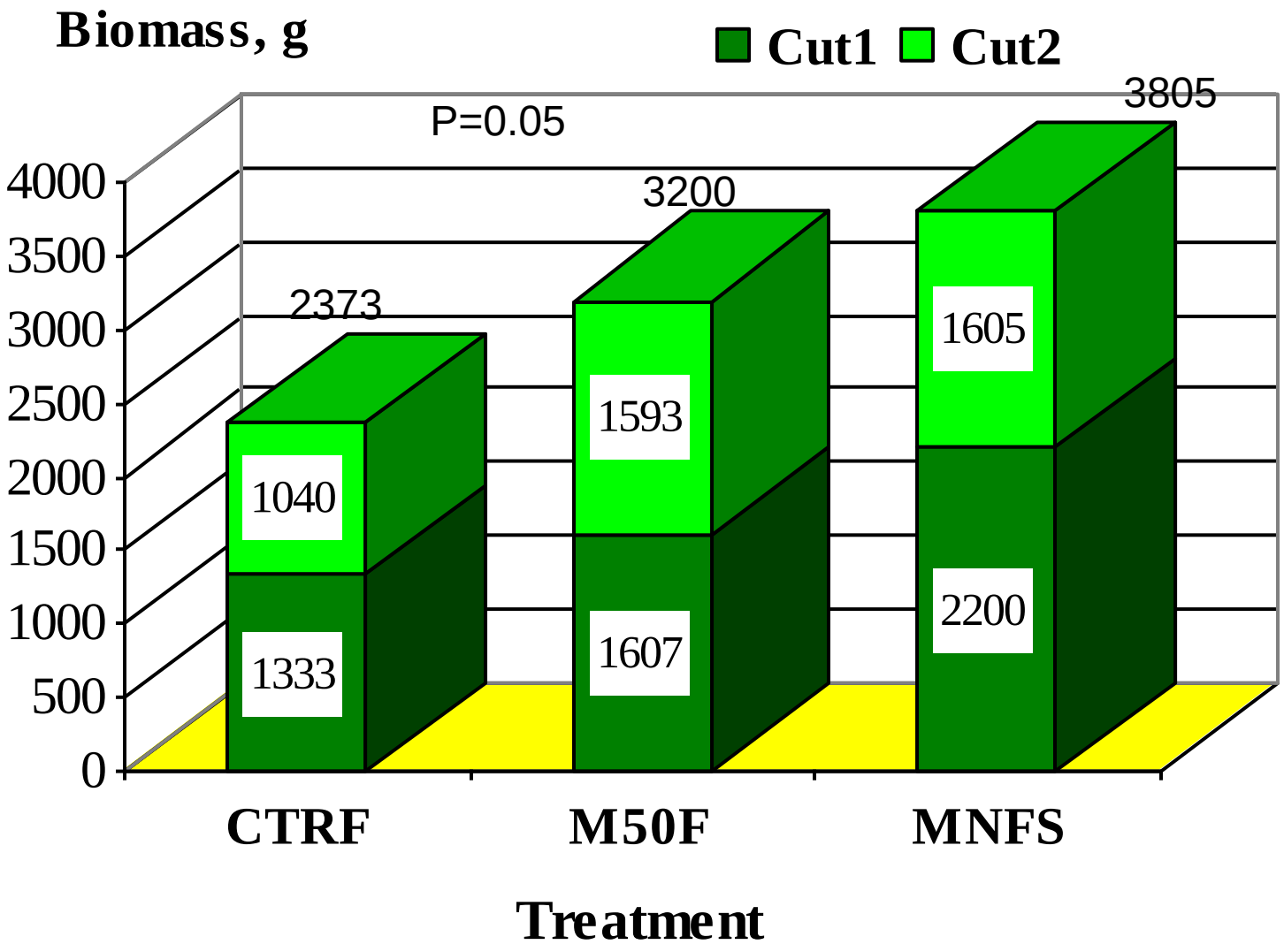
Coliform number in different samples



Nitrogen concentration in different samples

RESULTS AND DISCUSSIONS

- Experiment 3: ***Dried waste mud for growing water spinach, length and biomass***



Total biomass of water spinach in 2 cuts

Water spinach fertilised with chemical fertilizers

Water spinach fertilised 50% inorganic fertilizers and mud

Water spinach with waste mud only without chemical fertilizer

CONCLUSION

- **In dry season the duck swimming on fish pond farming system obtained higher benefits from weight gains of ducks and fish accompanied.**
- **Most of coliforms in waste water of the integration farming were reduced or eliminated in the growing rice field**
- **Waste mud and water in the integration pond could be used as an organic fertilizers to replace for chemical fertilizers in cultivation of rice.**
- **Waste mud in the pond could be dried and used to plant water spinach to obtain higher biomass and seen be as a safe vegetable for human consumption.**
- **Integated duck-fish system of the farmer farm scales will improve the knowledge of biosecure production of food with respect to safe production and sustainable development.**

THANK YOU
FOR YOUR ATTENTION