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Study of water hyacinth (*Eichhornia crassipes* L.) as feed for growing rabbits

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INTRODUCTION

- **Rabbit production more developed due to outbreaks of Avian Influenza**
- **Supply meat for human diets**
- **Rabbit meat contains high protein lower in fat and cholesterol (Jaouzi et al.,2004)**
- **Rabbits have no CH₄ emission**
- **Therefore, they reduce polluted environment**

INTRODUCTION

- **Water hyacinth grows fast, well almost year round, high biomass**
- **WH can absorb Pb, Cadmium, Hg... (Wolverton & MacDonald, 1978)**
- **Para grass (*Brachiaria mutica*) is good fiber source, high DM**
- **Optimum level of water hyacinth as replacement of Para grass give higher performance and better benefit**



Aims of the study

- To determine optimum levels of water hyacinth in diets on feed intake, growth performance of crossbred rabbits**
- To measure apparent digestibilities of nutrients**
- To generate information on economic impact for producers of using water hyacinth associated para grass in diets for rabbit production**

Feeds used for rabbits in Exp.

Para grass

DM (16-18 %)

CP (9.9 - 12 %)

NDF (65 -70 %)



Water hyacinth

(Eichhornia crassipes L.)

DM (6-7 %)

CP (11-12%)

NDF (57.3%)



Dried Cassava

DM (88 %)

CP (2.8 %)

NDF (15 %)



Soya waste

DM (9.5 %)

CP (19 %)

NDF (43 %)



METHODOLOGY

Feeding trial

- 72 rabbits at 8 weeks- LW: 800g
- A complete randomized design- 6 treatments- 3 replicates
- Experimental time: 9 weeks

Digestibility trial

- Similar design with feeding one
- Rabbits at 12 weeks- LW: 1500g
- Experimental time: 6 days for sample collection: feeds- urine- feces

METHODOLOGY

Table 1. Feed ingredient composition of diets

Feed	Treatment					
	WH0	WH20	WH40	WH60	WH80	WH100
WH,%	0	20	40	60	80	100
PG, g	<i>ad-lib</i>	<i>ad-lib</i>	<i>ad-lib</i>	<i>ad-lib</i>	<i>ad-lib</i>	-
DCas.,g	25	25	25	25	25	25
SW, g	200	200	200	200	200	200

PG: Para grass, WH: Water hyacinth, DCas: Dried cassava, SW: Soya waste



Experimental design in Feeding trial



Experimental design in digestibility trial



Rabbits in experiment

Measurements recorded

- ✓ **Feed and nutrient intakes: DM, OM, CP, EE, CF, NDF, ADF, ME**
- ✓ **Daily gain and FCR**
- ✓ **Nutrient digestibility: DM, OM, CP, CF, NDF (McDonald *et al.*, 2002)**
- ✓ **Nitrogen balance**
- ✓ **Economic returns**

Results of Feeding Exp.

Table 2. Chemical composition of feeds, % DM basis

Feed	DM	OM	CP	NDF	Ash	ME* (MJ/kgDM)
WH	7.63	82.5	11.7	57.3	17.5	8.29
Para grass	16.9	88.7	11.0	68.0	11.3	8.23
DCas	87.7	96.9	2.84	15.2	3.15	14.6
SW	9.52	94.5	19.1	42.8	5.50	11.2

*WH: water hyacinth, DCas: dried cassava, SW: soya waste, DM:dry matter, OM: organic matter, CP: crude protein, NDF: neutral detergent fibre, * Maerten et al. (2002)*

Table 3. Daily intake of feed and nutrient of rabbits fed different levels of WH (g/rabbit)

Item	Treatment						±SE/P
	WH0	WH20	WH40	WH60	WH80	WH100	
Fresh WH	-	102 ^a	181 ^b	257 ^c	331 ^d	273 ^c	5.35/0.001
Fresh PG	218 ^a	177 ^b	136 ^c	92.0 ^d	49.1 ^e	-	2.87/0.001
DM WH	-	7.33 ^a	13.0 ^b	18.3 ^c	23.6 ^d	19.7 ^e	0.410/0.001
DM PG	31.1 ^a	24.0 ^b	18.5 ^c	13.3 ^d	7.33 ^e	-	0.690/0.001
%WH/PG	-	23.6 ^a	41.7 ^b	59.1 ^c	76.2 ^d	100 ^e	1.20/0.001
DM	70.7 ^a	70.9 ^a	71.1 ^a	71.2 ^a	70.6 ^a	59.3 ^b	0.901/0.001
OM	65.9 ^a	65.8 ^a	65.5 ^a	65.2 ^a	64.3 ^a	54.3 ^b	0.758/0.001
CP	8.18 ^a	8.42 ^{ab}	8.51 ^b	8.53 ^b	8.50 ^b	6.81 ^c	0.001/0.001
NDF	32.5 ^a	32.0 ^a	31.4 ^{ab}	30.8 ^{ab}	29.8 ^b	22.4 ^c	0.572/0.001
ME*, MJ/rabbit	0.573 ^{ab}	0.582 ^a	0.589 ^a	0.614 ^a	0.601 ^a	0.500 ^b	0.024/0.007

Fig. 1. Daily intake of feeds and nutrients of rabbits fed different levels of WH (g/rabbit)

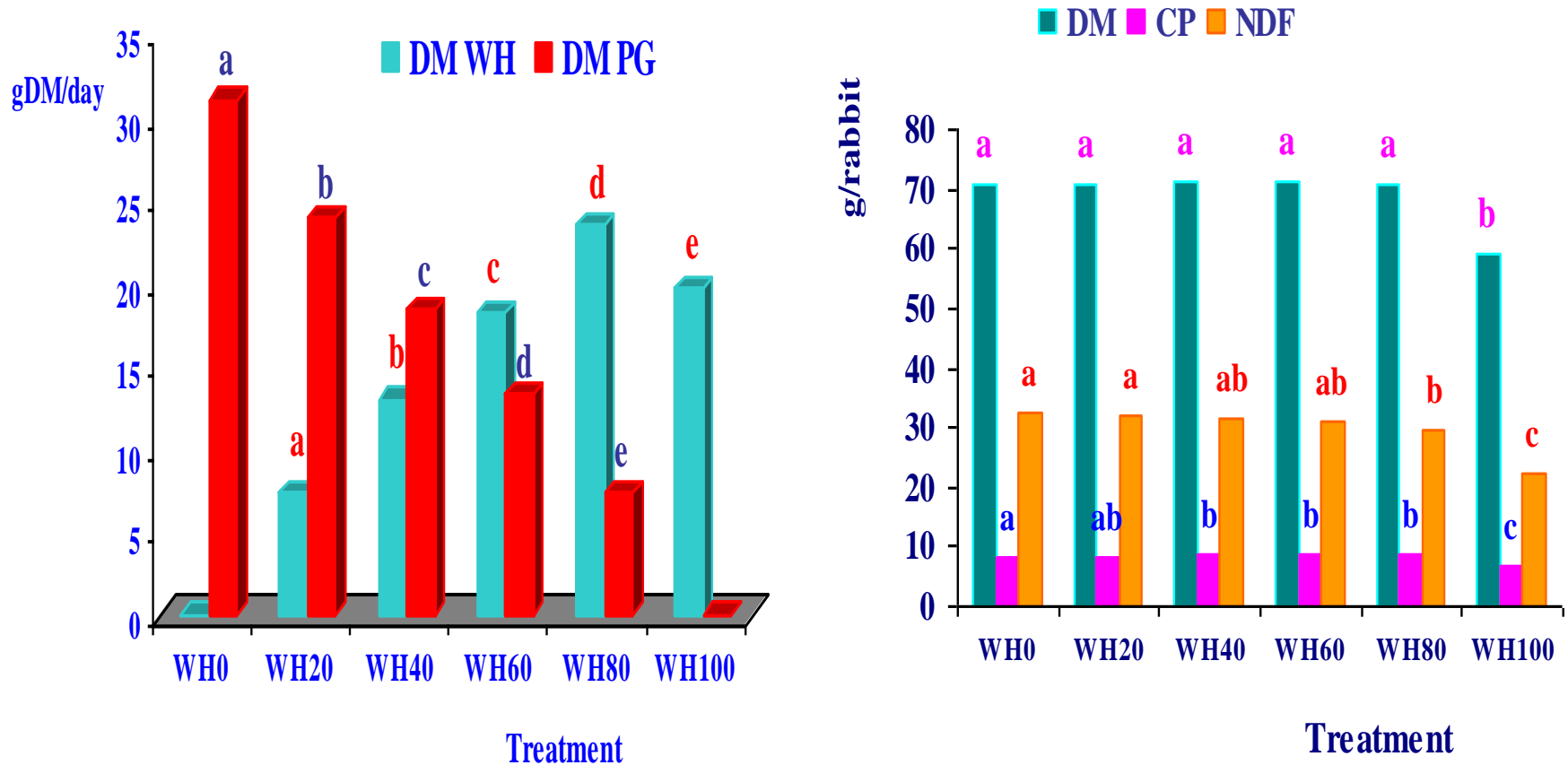


Fig 2. Effect of different levels of WH in diets on **DG** and **FCR** of rabbits

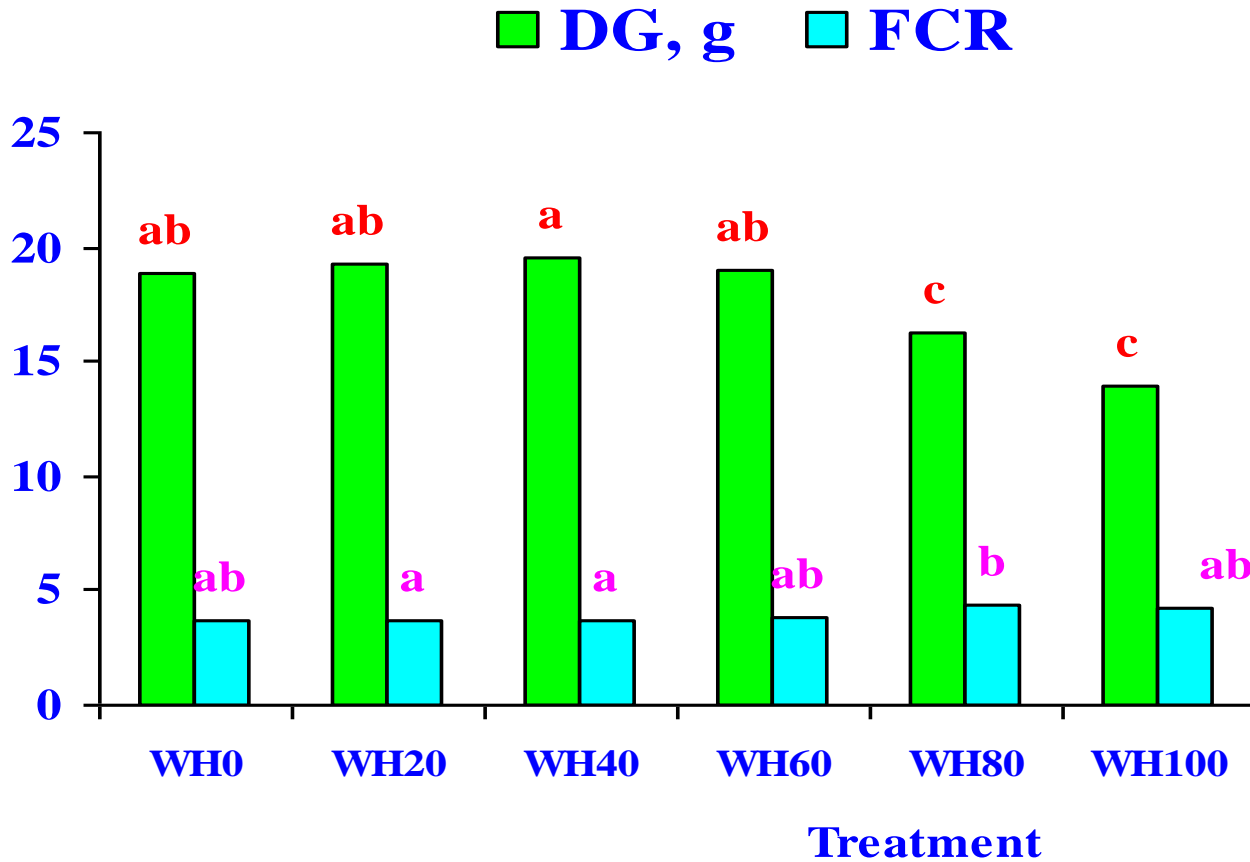


Table 4. Carcass parameters and digestible organs of rabbits in Exp.

Item	Treatment						±SE/P
	WH0	WH20	WH40	WH60	WH80	WH 100	
LW, g	2057 ^a	2123 ^a	2195 ^a	2035 ^a	2020 ^a	1700 ^b	43..2/0.001
Carcass W., g	953 ^a	967 ^a	1025 ^a	938 ^{ab}	910 ^{ab}	836 ^b	27.4/0.008
% Carcass	46.3	45.6	46.7	46.1	45.1	49.2	45.1/0.256
Lean meat W., g	683 ^{ab}	674 ^{ab}	714 ^a	668 ^{ab}	638 ^b	624 ^b	14.8/0.013
% Leameat	71.8	69.8	69.6	71.3	70.2	74.6	1.45/0.216
Thigh W., g	260 ^{ab}	270 ^{ab}	289 ^a	268 ^{ab}	255 ^{ab}	236 ^b	7.46/0.007
%Thigh W	38.0	40.1	40.6	40.2	40.0	37.9	1.34/0.569
CaecumW., g	175	170	176	156	191	146	11.0/0.134
Stomach W., g	175	168	192	193	224	170	14.2/0.119
Small instest leng., cm	284	292	284	291	301	232	22.5/0.364
Large instest leng., cm	122	122	124	123	133	118	3.35/0.121
Caecum leng., cm	45.7	46.7	40.0	46.0	43.3	42.7	1.83/0.165

Table 5. Effect of different levels of WH in diets on economic returns of rabbits, VND

Item	Treatment						±SE/P
	WH0	WH20	WH40	WH60	WH80	WH100	
Feed cost	17,989	18,226	18,182	18,046	17,902	15,936	-
Tot. expense	59,989	60,226	60,182	60,046	59,902	57,936	-
Tot. income	84,510	84,845	86,460	84,454	76,720	71,201	-
Profit	24,521	24,620	26,279	24,409	16,819	13,265	-

Results of digestibility Exp.

Table 6. Chemical composition of feeds, % DM

Item	DM	OM	CP	NDF	Ash	ME* MJ/kgDM
Water hyacinth	7.24	86.7	10.2	56.2	13.3	8.29
Para grass	18.2	90.7	10.1	67.5	9.35	8.23
Dried cassava	90.2	97.5	3.34	13.9	2.46	14.6
Soya waste	9.65	95.5	19.9	42.0	4.48	11.2

* Maerten et al., 2002

Table 7. Daily intake of feed and nutrient of rabbits fed different levels of WH in digestibility Exp. (g/rabbit)

Item	Treatment						±SE/P
	WH0	WH20	WH40	WH60	WH80	WH100	
Fresh WH	-	94.4 ^a	189 ^b	280 ^c	332 ^c	292 ^c	21.1/0.001
Fresh PG	209 ^a	144 ^b	136 ^b	96.9 ^c	48.8 ^d	-	8.02/0.001
DM WH	-	6.59 ^a	11.9 ^{ab}	17.1 ^{bc}	21.8 ^c	19.7 ^c	2.12/0.001
DM PG	26.5 ^a	18.2 ^b	19.4 ^{ab}	16.7 ^b	8.35 ^c	-	2.25/0.001
DM	68.4 ^{ab}	68.6 ^{ab}	73.2 ^a	75.6^a	72.0^{ab}	61.5^b	3.28/0.015
OM	64.5 ^{ab}	64.4 ^{ab}	68.3 ^a	70.3^a	66.9^{ab}	57.5^b	2.91/0.013
CP	8.23 ^a	8.30 ^a	8.70 ^a	8.73^a	7.93^a	6.80^b	0.27/0.001
NDF	29.3 ^a	28.7 ^a	31.5 ^a	32.6^a	29.1^a	19.6^b	1.94/0.001
ME, MJ/rabbit	0.539 ^{ab}	0.557 ^{ab}	0.601 ^{ab}	0.704^a	0.626^{ab}	0.529^b	0.052/0.043

Table 8. Nutrient digestibility (%) of rabbits fed different levels of WH

Item	Treatment						±SE/P
	WH0	WH20	WH40	WH60	WH80	WH100	
DMD	54,8	56,8	57,9	65,9	61,7	59,8	4,74/0,292
OMD	55,3	57,4	58,3	66,1	61,9	60,9	4,71/0,317
CPD	64,6	66,6	67,7	70,1	61,5	58,8	4,73/0,246
NDFD	40,8 ^{ab}	44,4 ^{ab}	45,7 ^{ab}	49,9^a	42,2 ^{ab}	40,0 ^b	3,63/0,044

DMD, OMD, CPD, NDFD: digestibility of DM, OM, CP and NDF

Means with different letters within the same rows are significantly different at P<0,05

Fig.3. Nutrient digestibility (%) of rabbits fed different levels of WH

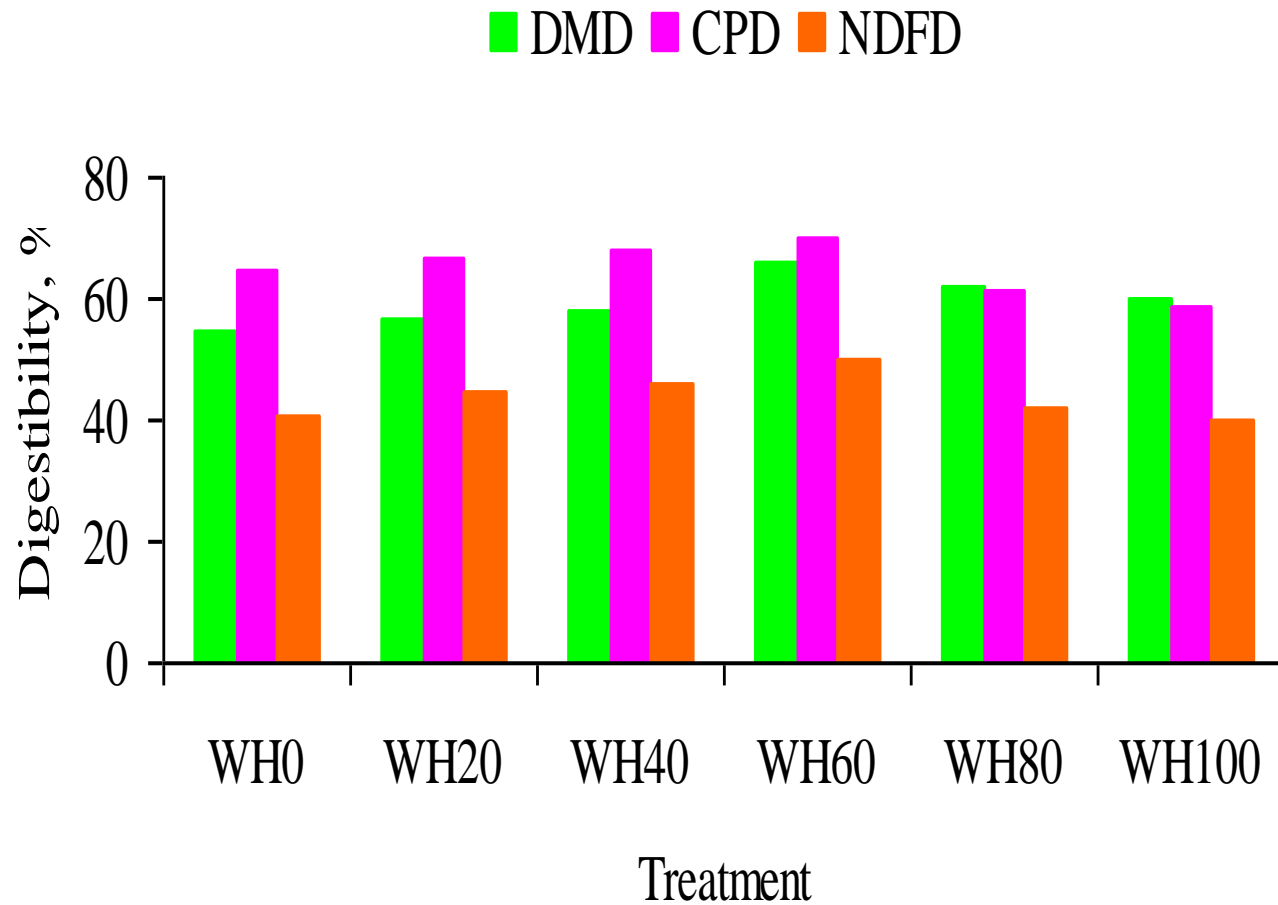


Fig 4. Effect of different levels of WH in diets on DM digestibility of rabbits

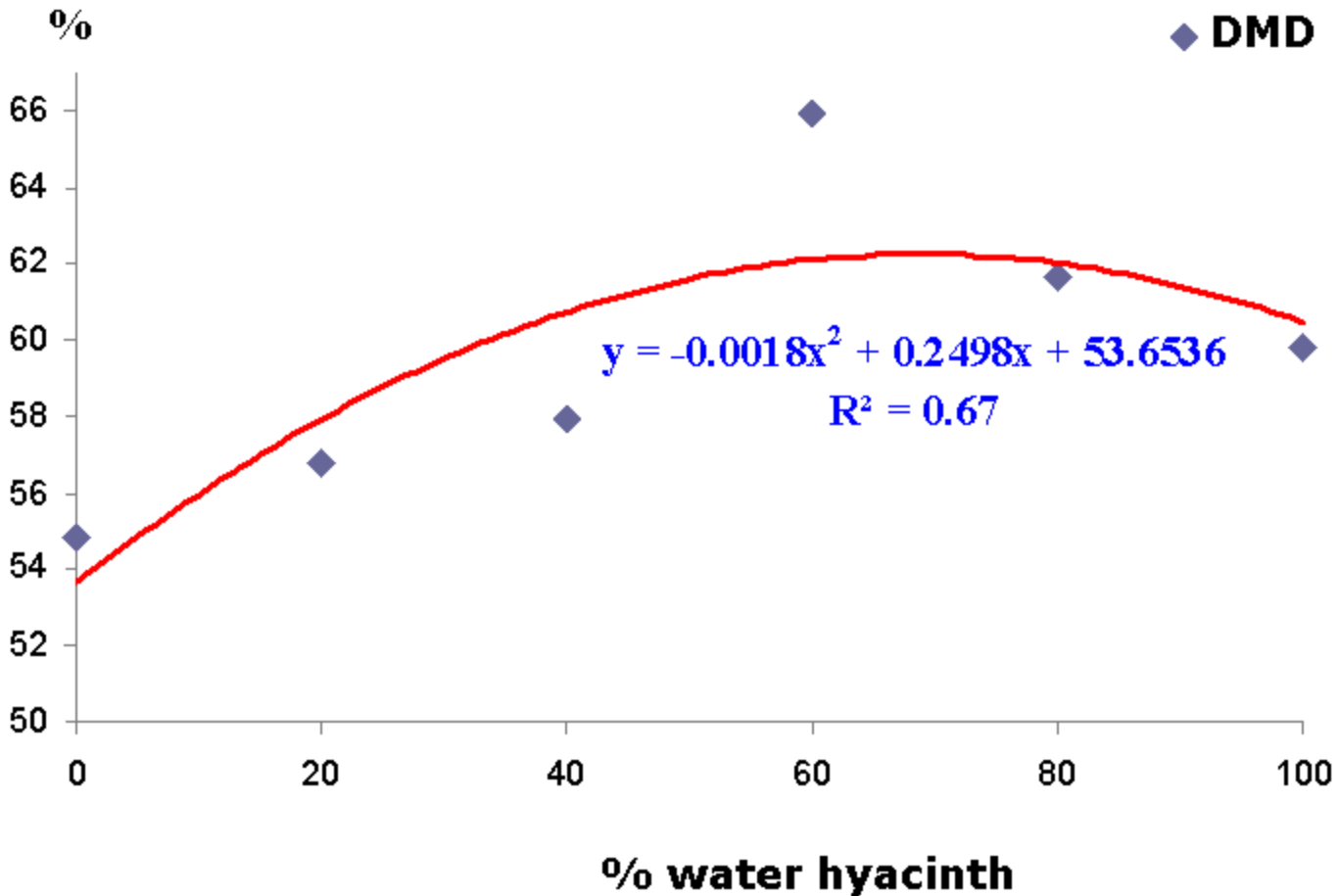
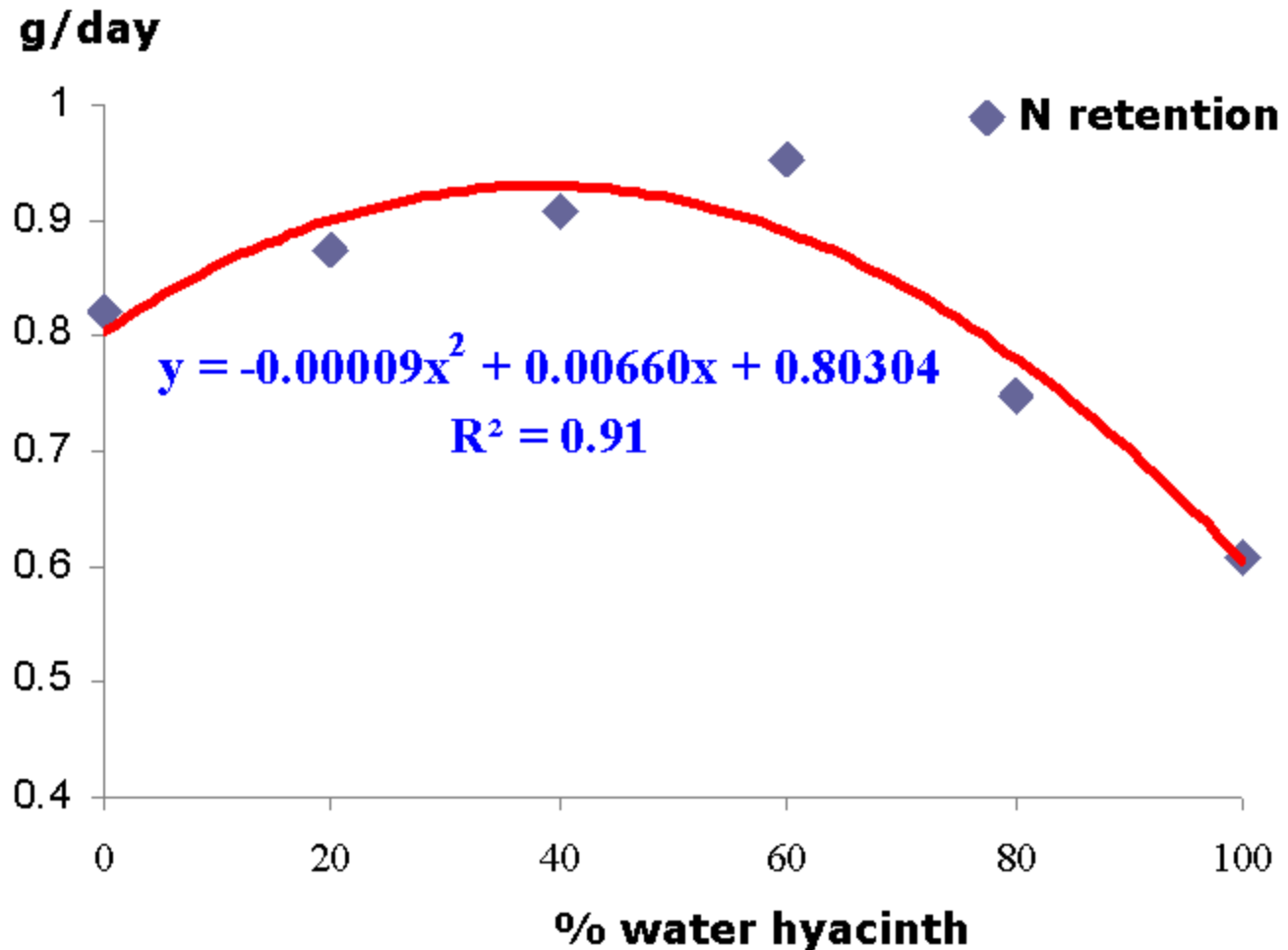


Table 9. Nitrogen intake and N retention of rabbits fed different levels of WH

Item	Treatment						±SE/P
	WH0	WH20	WH40	WH60	WH80	WH100	
N balance (g/day)							
N intake	1,32 ^a	1,32 ^a	1,40^a	1,40^a	1,27 ^a	1,09^b	0,043/0,001
N in feces	0,467	0,426	0,451	0,410	0,481	0,449	0,053/0,793
N in urine	0,029	0,025	0,039	0,033	0,035	0,034	0,009/0,736
N retention	0,820 ^{ab}	0,873 ^{ab}	0,907^a	0,953^a	0,747^{ab}	0,607 ^b	0,080/0,011

Fig 5. Effect of different levels of WH in diets on N retention (g/rabbit/day) of rabbits



CONCLUSION AND IMPLICATION

- **Water hyacinth could be used as feed for feeding rabbits**
- **Levels from 40 to 60% water hyacinth in diets gave high growth performance and better profits**
- **Nutrient digestibility and N retention were improved in diets included from 40 to 60% water hyacinth**
- **Further study on micro organism activity and fermentation of cecum fluid of rabbits fed water hyacinth**

**THANK YOU VERY FOR
YOUR KIND INTENTION !**