Small-scale fish production with local feed resources



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Studies Lantocksuniversitet Swedish University of Agricultural Sciences

Global fish supplies

- "Farming can contribute to global (net) fish supplies, only if current trends in fish meal and fish oil use for aquaculture are reversed" [Naylor et al. 2000. Nature 405, 1017-1024]
- * Aquaculture's share of global fish meal consumption \sim $70^{\circ}\%$ and of global fish oil consumption ~ $90^{\circ}\%$ [Naylor et al., 2009. PNAS 106, 15103-15110]

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What can be done?

- Reduce the use of fish meal and fish oil in aquaculture and livestock production
 - · Plant based protein feed sources
 - · Choice of fish species for culture
- Integrated production systems
 - · Integrate aquaculture, crop and livestock production
- Use closed fish production systems with control of nutrient and particle flow
 - · Ponds or other land-based systems

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Fish culture systems

o Extensive

- Earthen ponds No or minimal nutrient input to the pond (irregular waste-feeding) Semi-intensive

 - Earthen ponds or water body with net cages
 Regular nutrient input to the pond (waste-fed)
 Fattening of cultured fish for marketing
- Intensive
 - · Earthen ponds or water body with net cages

Continuous feeding of fish

J. SLU Integrated aquaculture and livestock production















Local feed resources and fish growth performance



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Hybrid ca	tfish	– die	t ing	redi	ents
Item	С	CLM	CLM- Lys	SHM	SHM- Lys
Fish meal	340	170	170	170	170
Shrimp head meal	0	0	0	260	250
Cassava leaf meal	0	645	645	0	0
Rice bran	320	100	91	340	347
Cassava root meal	200	0	0	0	0
Oil	80	25	30	170	170
Minerale + vitamine	40	40	40	40	40

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Hybrid catfish – diet composition

Item	с	CLM	CLM- Lys	SHM	SHM- Lys
Crude protein	301	302	301	298	298
Crude fat	145	121	118	262	253
Crude fibre	25	82	79	21	19
Ash	81	83	81	125	122
Lysine	15.5	12.5	16.5	14.1	16.9
Gross energy (MJ)	18.8	18.9	19.0	18.9	18.8

Composition in g/kg DM; CLM = cassava leaf meal; SHM = shrimp head meal

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Hybrid catfish - performance

Item	С	CLM	CLM- Lys	знм	SHM- Lys	P- value
Final weight, g	21.4b	18.0d	19.1c	21.5b	22.8a	0.001
FCR (g/g)	1.47	1.59	1.54	1.39	1.45	0.194
PER	2.25	2.07	2.16	2.41	2.30	0.136
Survival	96.7	95.6	93.3	94.4	93.3	0.193

Initial weight = 3.8 g; CLM = cassava leaf meal; SHM = shrimp head meal

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Amcan ca	atrisi	1 – ai	et in	grea	ients
ltem	C	GAS- A5	GAS- M20	GAS- Raw	
Fish meal	232	0	0	0	
Rice bran	753	772	714	776	
GAS-A5	0	213	0	0	
Gas-M20	0	0	271	0	
Gas-Raw	0	0	0	209	
		10	10	10	

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African catfish - diet composition

Item		GAS- A5	GAS- M20	GAS- Raw
Crude protein	263	258	260	264
Crude fat	183	163	181	175
Crude fibre	127	194	136	144
Ash	143	141	131	154
Gross energy (MJ)	20.6	20.2	20.8	20.3

GAS = Golden Apple snail; A5 = 5% ascorbic acid; M20 = 20% sugar-cane molasses

African ca	atfish	ı - pe	rforn	nanc	e
Item	С	GAS- A5	GAS- M20	GAS- Raw	P- value
Initial weight, g	15.8	16.5	17.0	16.8	0.228
Final weight, g	30.2	31.3	32.1	31.6	0.131
FCR (g/g)	1.9	1.9	2.0	2.0	0.886
PER (g/g)	2.0	2.4	2.2	2.1	0.360
GAS = Golden Apple M20 = 20% sugar-car	snail; A5 = ne molass	= 5% asco es	rbic acid;		

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Asian cat	fish -	diet	ingr	edie	nts
Item	С	CLM	GAS	SHM	Rice bran
Fish meal	260	195	0	0	0
Vegetable protein	480	400	480	480	0
Wheat flour	200	200	220	260	0
Cassava leaf meal	0	145	0	0	0
Golden Apple snail	0	0	240	0	0
Shrim head meal	0	0	0	200	0

 Minerals + vitamins
 20
 20
 20
 20
 20

 Composition in g/kg DM; CLM = cassava leaf meal; GAS = Golden Apple snail; SHM = shrimp head meal
 SHM = shrimp head meal

0

20

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Asian catfish – diet composition Item C CLM GAS SHM Rice bran Crude protein 225 227 227 124 Crude protein 45 44 214 215 106

Crude fat	45	44	31	35	106
Crude fibre	29	51	53	59	84
Ash	102	73	41	89	72
Gross energy (MJ)	16.2	17.1	16.8	15.9	17.6

Composition in g/kg DM; CLM = cassava leaf meal; GAS = Golden Apple snail; SHM = shrimp head meal

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Rice bran

Oil

Asian catfish - performance

Item	С	CLM	GAS	SHM	Rice bran	P- value
Initial weight, g	16.1	16.2	16.2	16.2	16.1	-
Final weight, g	229 ^{ab}	178 ^c	222 ^b	257ª	84 ^d	0.02
FCR (g/g)	1.66 ^b	1.97 ^b	1.54 ^b	1.42 ^b	4.47 ^a	0.02
PER	2.96 ^a	2.35ª	3.15ª	3.18 ^a	0.84 ^b	0.01
Survival	95.2	90.5	93.5	95.2	92.2	0.62

Composition in g/kg DM; CLM = cassava leaf meal; GAS = Golden Apple snail; SHM = shrimp head meal

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Conclusion

- Great potential in several non-conventional feed resources to be used in fish feeding.
- The pond ecosystem can provide nutrients to cultured fish in addition to offered feed.

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Additional information

- Phonekhampheng, O., 2008. On-farm feed resources for catfish (Clarias gariepinus) production in Laos-Evaluation of some local feed resources. SLU, Acta Universitatis Agriculturae Sueciae, Faculty of Veterinaty Medicine and Animal Science, Doctoral thesis no. 2008: 89.
- Nguyen Duy Quynh Tram, 2010. Evaluation of local feed resources for hybrid catfish (Clarias macrocephalus x C. gariepinus) in smallholder fish farming systems in Central Vietnam. SLU, Acta Universitatis Agriculturae Sueciae, Faculty of Veterinary Medicine and Animal Science, Doctoral thesis no. 2010: 72.
- Chau Thi Da, 2012. Evaluation of locally available feed resources for striped catfish (Pangasianodon hypopthalmus). SLU, Acta Universitatis Agriculturae Sueciae, Faculty of Veterinary Medicine and Animal Science, Doctoral thesis no. 2012: 89.

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Activities in Africa

- * International workshop on Sustainable aquaculture in Southern Africa organized by SLU and Makerere University, Uganda
 - In Kampala, Uganda, 5-8 February 2013
 - Participants from 6 African countries
 - Uganda, Kenya, Tanzania, Rwanda, Malawi & Cameroon
 - Financed by the Swedish Foreign Ministry (UD-40)
- Continued contact in different connections
 - Applications for funding
 - Discussions in connection with preparation of a concept note for continued SIDA support to Uganda by Makerere University

