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FMM/RAS/298: Strengthening capacities, policies and national action plans on prudent and responsible use of antimicrobials in fisheries Workshop 2  
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# Alternatives to antibiotics in carp aquaculture

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# SOME EXAMPLES OF IMPROVED PRODUCTIVITY WITH GAP

## TCP/CPR/3203 (D) Improvement of Aquaculture Food Safety in Hubei Province

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# Problems faced by carp farmers in Songzi

- Low production levels
- Frequent disease problems
- Lack of diagnostic support
- Frequent use of veterinary medicines
- Low economic returns





Discussion of aquaculture practices with fish farmers



Improvement of pond conditions- Desiltation of ponds





Support for disease diagnosis and  
water quality monitoring laboratory

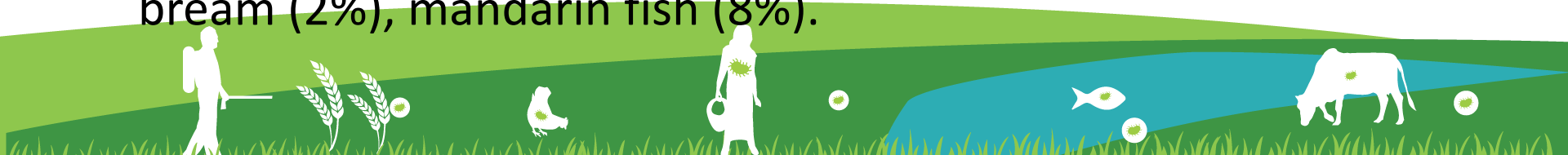


Training of trainers



# Good Aquaculture practices developed

- Desiltation and pond preparation before stocking
- Improvement of water intake channels
- selection of healthy seeds from hatcheries adopting good practices
- quarantining the seeds before stocking
- Modifying the stocking ratio as grass carp (56%), silver carp (12%), bighead carp (12%), crucian carp (10%), blunt snout bream (2%), mandarin fish (8%).



# Good Aquaculture practices developed

- monitoring water and sediment quality at regular intervals and taking remedial actions such as water exchange and aeration
- reducing feed wastage
- minimizing use of chemicals, use of some herbal remedies for infection and occasional use of water disinfectant in case of disease outbreak in neighbouring ponds
- use of laboratory services for technical support like monitoring pond water and sediment quality and disease diagnosis.

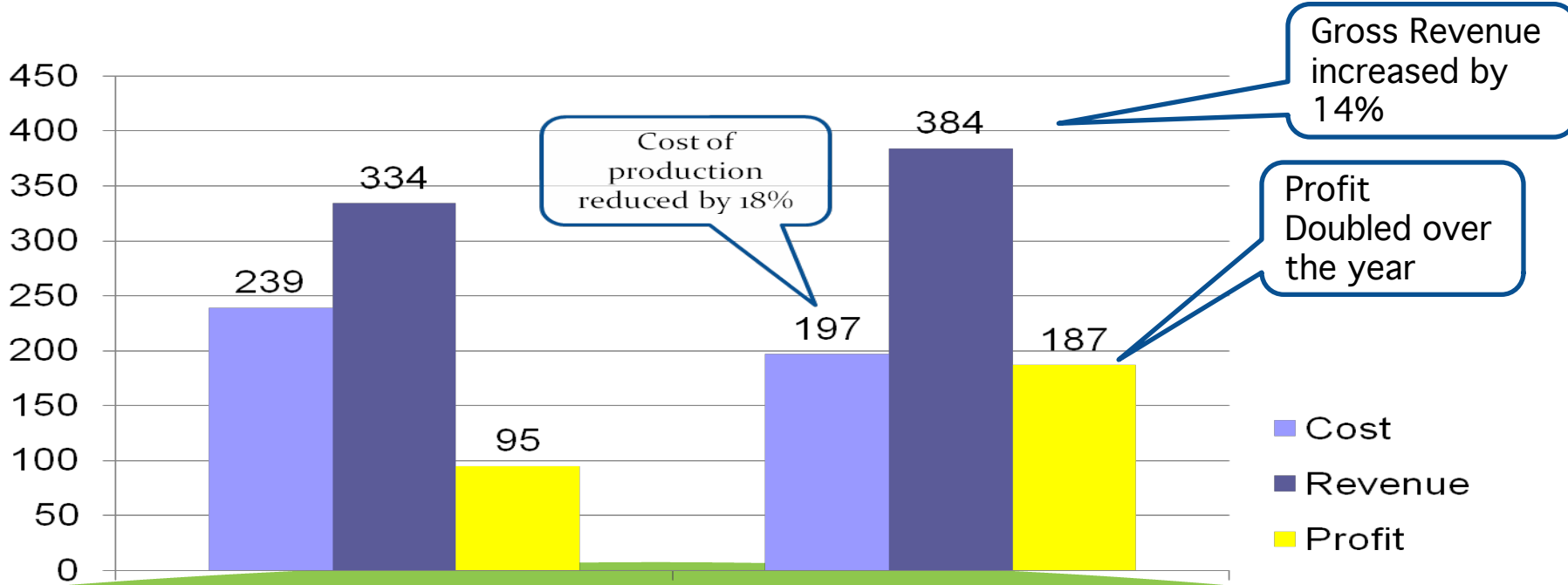


# Monitoring

- **Water quality:** turbidity, pH, ammonia content, algal blooms, DO meter
- **Sediment quality:** Biochemical Oxygen Demand (BOD),  $H_2S$ ,
- **Fish health:** gasping, presence of external parasites, colour appearance, activity



# Economics (US\$ per ha)



# Alternatives to antimicrobials pertaining to diseases affecting carps in China

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The Chinese government encourages to explore and practice antibiotics-free fish farming related technologies and products.



The major purpose of using antibiotics in aquaculture consists of two different aspects:

- Control bacterial diseases (antimicrobial activity and immune stimulant).
- Promote growth performance



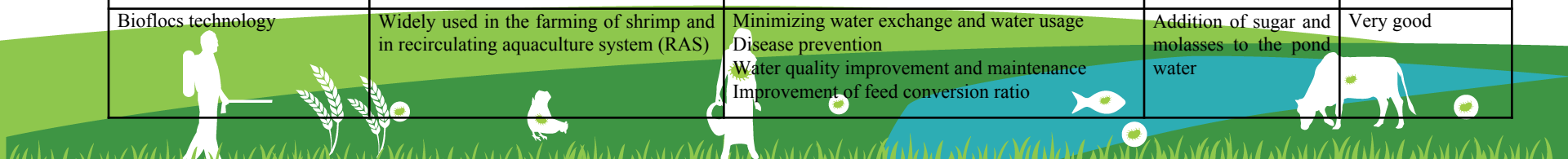
# The major category of alternatives to antibiotics used in aquaculture in China

- ◆ Phytochemicals (plant-derived compounds )
- ◆ Vaccine
- ◆ Dietary acidifiers, short-chain fatty acid
- ◆ Bacteriophage
- ◆ Probiotics
- ◆ Prebiotics: Short-chain carbohydrates (oligosaccharides)
- ◆ Egg yolk antibody(IgY)
- ◆ Antimicrobial peptides
- ◆ Bioflocs technology



# The status summary of alternatives to antibiotics used in China

Alternatives to antibiotics	Development status	Potential functions	Administration method	Effect in field application
Herbal medicines/medicinal plant extracts	Widely used commercially	Anti-microorganism activity Stress prevention Immune stimulation Improvement of feed palatability, Growth promotion Anti-inflammation activity Disrupting quorum sensing	Oral route	Good or uncertain
Vaccine	Some products are available	Disease prevention	Injection and bath	Very good
Dietary acidifiers, short-chain fatty acids, organic acid	Available commercially, but not so popular	Disease prevention Growth performance improvement	Oral/water route	unproved
Bacteriophage	Available commercially	Disease prevention	water route	unproved
<i>Bdellovibrio bacteriovorus</i>	Available commercially	Disease prevention	water route	unproved
Probiotics	Widely used commercially	Disease prevention Water quality improvement	Oral/water route	Very good
Prebiotics: oligosaccharides	Available commercially, but not so popular	Disease prevention Growth performance improvement	Oral route	unproved
Egg yolk antibody (IgY)	At experimental stage with few field test No commercial products are available	Disease prevention and treatment Growth performance improvement	Mainly with feed	Vary
Antimicrobial peptides	At experimental stage, few field test	Disease prevention	Oral route	unproved
Bioflocs technology	Widely used in the farming of shrimp and in recirculating aquaculture system (RAS)	Minimizing water exchange and water usage Disease prevention Water quality improvement and maintenance Improvement of feed conversion ratio	Addition of sugar and molasses to the pond water	Very good



# The most commonly used herbal medicine and their extracts in aquaculture in China. The vast majority are used in the form of compound preparations



黄连和黄连素 *Coptis chinensis* and berberine  
 黄芩 *Scutellaria baicalensis*  
 黄柏 golden cypress  
 蒲公英 dandelion  
 博落回 *Macleaya cordata*  
 金银花 *Lonicera japonica*  
 黄芪 *Astragalus mongholicus*  
 黄芪多糖 *Astragalus polysaccharides*  
 贯众 *Cyrtomium fortunei*  
 板蓝根 isatis root  
 鱼腥草 *Houttuynia cordata* Thunb  
 当归 *Angelica sinensis*  
 何首乌 *Polygonum multiflorum*  
 肉桂 *Cinnamomum cassia*;  
 刺五加 *Acanthopanax senticosus*  
 党参 *Codonopsis pilosula*  
 杜仲 *Eucommia ulmoides*  
 甘草 *Glycyrrhiza uralensis*  
 灵芝 *Ganoderma lucidum*  
 茯苓 *Poria cocos*  
 青蒿 *Artemisia apiacea*  
 丹参 *Salvia miltiorrhiza* Bge  
 使君子 *Quisqualis indica*  
 南瓜子 pumpkin seed  
 十大功劳 *Mahonia fortunei*

槟榔 *Areca catechu*  
 常山 *Dichroae Radix*  
 马齿苋 *Portulaca oleracea* L.  
 大蒜和大蒜素 Garlic and Allicin  
 地锦草 *Euphorbia humifusa*  
 虎杖 *Polygonum cuspidatum*  
 青黛 *Indigo naturalis*  
 穿心莲 *Andrographis paniculata*  
 连翘 *fructus forsythiae*  
 柴胡 *bupleurum falcatum*  
 大黄 *Rheum officinale*  
 马齿苋 *Portulaca oleracea*  
 辣蓼 *Polygonum hydropiper*  
 白头翁 *Pycnonotus sinensis*  
 苦参 *Sophora flavescens*  
 五倍子 gallnut  
 牛蒡 *Arctium lappa* L  
 何首乌 *Polygonum multiflorum*  
 肉桂 *Cinnamomum cassia*  
 苍术 *Atractylodes lancea*  
 地肤子 *Kochia scoparia*  
 姜黄 *Curcuma longa* L  
 乌柏 *Sapium sebiferum*  
 半夏 *Pinellia ternata*  
 半边莲 *Lobelia chinensis*



# Vaccines

## Approved fish vaccines in China



Pathogens or vaccines	Target fish host or diseases
<i>Edwardsiella tarda</i> (strain EIBAV1) avirulent live vaccine	<i>Scophthalmus maximus</i> ( Turbot)
<i>Aeromonas hydrophila</i> (strain J1)	Motile Aeromonads Septicemia(MAS) of freshwater fish
Grass carp reovirus, GCRV ( Killed) Grass carp reovirus, GCRV (Attenuated) Inactivated Diseased fish Tissue homogenate vaccine	<i>Ctenopharyngodon idellus</i> (Grass carp) & <i>Mylopharyngodon piceus</i> ( black carp)
Multi-vaccine of anti-idiotypic antibody against <i>Vibrio alginolyticus</i> , <i>Vibrio</i> <i>anguillarum</i> and <i>Edwardsiella tarda</i>	<i>Paralichthys olivaceus</i> (Flounder)
Iridovirus (strain Ehime-1 and GF14)	<i>Pagrus major</i> , <i>Seriola</i> spp., <i>Pseudocaranx</i> <i>dentex</i>
<i>Lactococcus garvieae</i> (strain BY1)	<i>Seriola quinqueradiata</i>



**Field injection inoculation(L) and bath inoculation (R)**

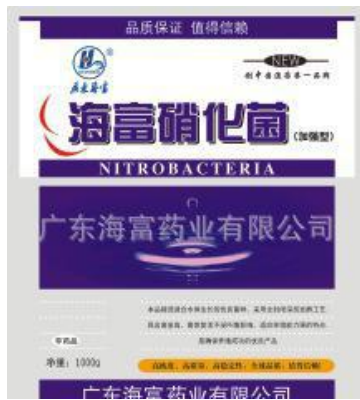


# The most commonly used commercial probiotic product category in aquaculture



- Bacillus spp.
- Lactic acid bacteria (LAB)
- photosynthetic bacteria
- Effective Microorganisms (EM)
- Nitrifying and denitrifying bacteria
- ***Bdellovibrio bacteriovorus***
- Yeasts
- others





使用简单 全程指导

水产专用EM菌

用于各种水产养殖  
净水 肥水  
增加浮游生物  
加工发酵各种饲料

350元/盒 10瓶/盒  
高富行电话: 15136200973

厂家直销 质量保证



# Bacteriophage and bacteriophage lysins



- Bacteriophage have been tested against a number of enteric pathogens in fish, including *Vibrio parahaemolyticus*, *Aeromonas hydrophila*, *Shewanella smarflavi*, *Vibrio cyclitrophicus*, etc.
- Three type of cell wall lytic enzymes: lysozyme, N-acetylmuramoyl-L-alanine amidase and endopeptidases



# Dietary acidifiers

- ◆ Lower gastric pH, resulting in increased activity of proteolytic enzymes, improved protein digestibility and inhibiting the proliferation of pathogenic bacteria in GI tract.
- ◆ Acidifiers could be related to reduction of gastric emptying rate, energy source in intestine, chelation of minerals, stimulation of digestive enzymes and intermediate metabolism.
- ◆ The exact mode of action still remains questionable.



# Egg yolk antibody(IgY)

- Antibodies can be administered in the feed in several forms including whole egg powder, whole yolk powder, water-soluble fraction powder or purified IgY.
- IgY antibodies have been tested against a number of enteric pathogens in fish including *Aeromonas hydrophila*, *Edwardsiella tarda*, *Listonella anguillarum* and WSSV with varying degrees of success.

The mechanism through which IgY counteracts pathogen activity has not been determined. Proposed mechanism includes:

- agglutination of bacteria,
- inhibition of adhesion
- opsonization followed by phagocytosis
- toxin neutralization.



# Antimicrobial peptides

- ◆ They have been isolated and characterized from virtually all living organisms ranging from prokaryotes to humans. They are important components of the host's defense system and are effector molecules of innate immunity with direct antimicrobial and mediator function.
- ◆ Peptides have a narrow spectrum of activity so they can be used to target specific pathogenic bacteria without affecting the normal native flora.
- ◆ There is almost no risk of residues in meat because they are proteins and therefore will not be absorbed as an intact molecule.
- ◆ In addition, antimicrobial peptides can tolerate a wide range of pH and temperatures.



# Bioflocs technology

- ◆ Biofloc technology minimizes water exchange and water usage in aquaculture systems through maintaining adequate water quality within the culture unit.
- ◆ Biofloc technology aims at enhancing water quality through balancing C and N.
- ◆ Heterotrophic bacteria assimilate inorganic N waste into biomass producing low cost bioflocs rich in protein.
- ◆ The bioflocs can be used as proteinaceous feed for the cultured animals.
- ◆ Bioflocs protect different aquaculture animals from bacterial infections through PHB and PHB-accumulating bacteria.







