

Quality Fish Seed in Bangladesh: Contribution of BFRI



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Background

- ❑ For good aquaculture practice (GAP), use of quality seed in fish farm plays vital role for higher production & good return
- ❑ The demands of fish seeds for aquaculture are met up by **Private hatcheries (913) 98.42%, Govt. hatcheries 1.19% & Natural sources 0.40%**
- ❑ **Inbreeding & unplanned hybridization** is a major problem in seed production in most of the hatcheries of Bangladesh
- ❑ Rapid expansion & extensive operation of hatcheries resulted **poor reproductive performance, retarded growth & diseases of hatchery seeds** have been frequently reported

- ❑ This sort of stock deterioration is due to **poor brood stock management, inbreeding depression & unplanned hybridization** in hatcheries
- ❑ To minimize **inbreeding depression & brood stock deterioration, genetic improvement through breeding programs** need to be undertaken with the involvement of hatchery owners, farmers & other stakeholders
- ❑ **Upgradation of broods & dissemination of quality seeds** to the stakeholders is a continuous process & which is essential from **generation to generation**
- ❑ To minimize broodstock deterioration, **BFRI is making much effort to generate improved breeds**
- ❑ In the meantime **BFRI evolved four improved breeds of carps & Tilapia** that could be disseminated throughout the country

Fish Seed Production Scenarios in Bangladesh

- ❑ The country has 3rd largest fish genetic resources in Asia behind China & India with 296 Fresh & Brackishwater species and also 511 marine species
 - Available cultivable endemic species
 - 13 species of carps (both major & minor)
 - 5 species of catfishes & 1 climbing perch

- ❑ Endemic fish species used in hatcheries for seed production
 - Total number of species: 14
 - Among them catla, rohu, mrigal, calbasu, bata, shing, magur, pabda, gulsha are predominant

- ❑ Other species are being used for seed production either under limited scale or for conservation purpose
 - Available cultivable exotic species in Bangladesh
 - 8 species of carps (Chinese carps and silver barb)
 - 2 species of catfishes & 3 species/strains of tilapias

Overview of Carp & Catfish Seed Production in BD (2010-11)

Categories of Hatchery	Total No. of Hatcheries	Quantity of spawn Produced (kg)	Contribution (%)
Private	854	4,59,804	98.81
Govt.	77	5,550	1.19
Total =	931	4,65,354	100

Indian Major carps=50% ; Exotic carps=35% & Catfish & others=15%

(Data Sources: FRSS, DoF, Ministry of Fisheries & Livestock, Bangladesh)

Reasons of Stock Deterioration

Endemic Carp

- ❑ **Absence of good genetic management practice in hatchery stocks**
- ❑ **Mass seed production target is the main objective (Not on quality)**
- ❑ **Brood stock replacement is from leftover fish**
- ❑ **Degradation in genetic quality of seeds**
 - due to inbreeding & negative selection
 - due to hybrid introgression in some major carp species

Note: Inbreeding has negative effects on Growth, survival, reproduction etc.

Exotic Carp

- ❑ **Founder stocks from unknown sources**
- ❑ **Chinese carps originally introduced in Bangladesh were secondary or tertiary transfer from countries other than China**
- ❑ **Small numbers of parent stocks contributing to an introduction of genetic drift**
- ❑ **Lead to poor performance through low genetic variation**
- ❑ **Inter-specific hybridization has recently been reported & experimentally proved (BFRI)**

Fish Seed Production Practices in Private Hatcheries

- ❑ No planned brood stock replacement guide lines are being followed by private hatcheries for carps, catfishes & tilapias
- ❑ For breeding programs, Private hatchery operators never bother to maintain “Effective Population Size (N_e)”
- ❑ Family size variation might be the main reason of decreasing the rate of genetic variability & increasing the level of inbreeding depression in a particular stock
- ❑ No systematic protocols and guidelines are being strictly followed presently for the maintenance of improved breeds/strains most by the private sector hatcheries
- ❑ Mostly Private hatchery operators have limited basic knowledge of simple brood stock management aspects and they don't usually maintained their stocks separately in different ponds

BFRI for Quality Seed Production

Genetic Stock Improvement Tools used by BFRI

Genetic techniques are being used for stock improvement as follows:

- ❑ Cross breeding between wild stocks
 - ✓ Rohu, Catla, Silver barb and Koi
- ❑ Selective breeding in 4 species
 - ✓ Improved strains of Rohu, Silver barb, BFRI GIFT tilapia & Koi
- ❑ Planned hybridization/cross breed of desirable species
 - ✓ Endemic Vs Exotic catfish, Thai Vs Local Koi

Genetic techniques may be as follows:

- ❑ Production of Triploid/Sterile population
 - ✓ Rohu, Mrigal & Shing
- ❑ Production of Gynogenetic population
 - ✓ Monosex female of Rohu, Mrigal & Silver barb
- ❑ Production of mono-sex using hormonal sex reversal
 - ✓ Monosex all male BFRI GIFT tilapia

Quality Seed Production Protocol (Mass Selection)

Wild / Improved Germplasms

Improved Nursery Management

Selection of 1500-2000 fingerlings based on best growth performance

Rearing at grow out ponds

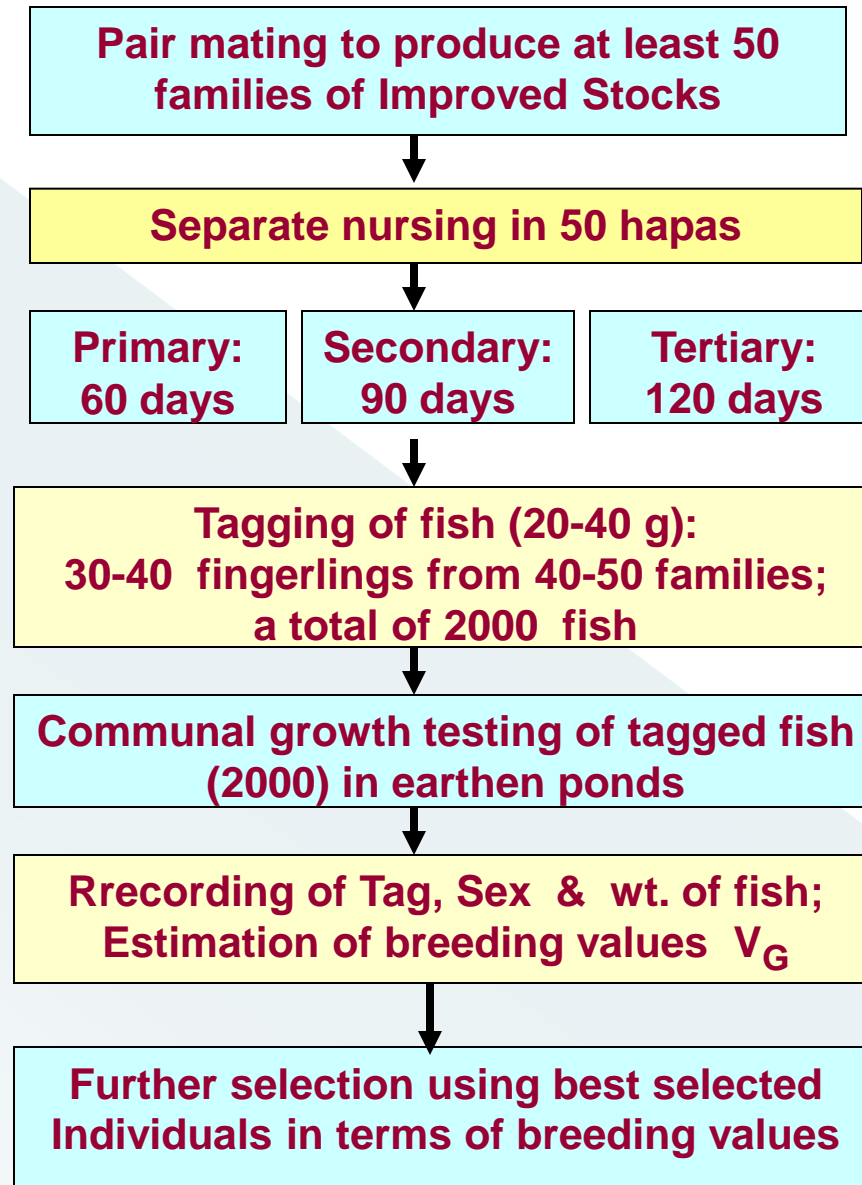
Selection of 20% fish as brood stocks through mass selection protocol

Rearing at brood pond @ 2500/ha up to maturity level for breeding

Use of brood for quality seed production

Quality seed will be disseminated to farmers

Quality Seed Production Protocol (Family Selection)



Significant research achievement

Fish stock improvement through genetic selection

- ◉ **BFRI Rajpunti:**
32-36% higher growth rate than normal breed
- ◉ **BFRI GIFT Tilapia:**
35-40% higher growth rate than normal breed
- ◉ **BFRI Rohu:**
15-20% higher growth rate than normal breed



Significant research achievement

Fish stock improvement through genetic selection

- **Monosex male tilapia production**
- **All-male tilapia production (96-98%) using hormonal sex manipulation technique**
- **Improved tilapia seed production & grow-out technique**



Significant research achievement

Brood development, breeding & seed production

- ◉ Breeding and mass seed production technique of both endemic & exotic Koi (*Anabas testudineus*) strains
- ◉ Breeding and mass seed production technique of magur (*Clarias batrachus*) and shingh (*Heteropneustes fossilis*)



Significant research achievement

Brood development, breeding & seed production of Pangas

- ◎ **BFRI first evolved breeding technology and mass seed production of Thai pangas in 1993**
- ◎ **BFRI succeeded captive breeding of the native species of pangas in 2004**



Recent Stock Details of Pangas



Thai (Red meat)



Vietnamese (White meat)

Origin	Year of Collection	Special feature	Widely Known	Present Status
Thailand	Oct.' 2010	Wild stock from Mekong river (Red meat)	Thai Pangas/Sutchi	Stock improvement program is in progress through rotational group breeding techniques
Vietnam	Oct' 2011	Wild stock from Mekong Delta (White meat)	Vietnamese Tra	

Significant research achievement

Brood development, breeding and seed production

- Early (1-2 months) brood maturation and egg development of prawn (*Macrobrachium rosenbergii*) through controlling the winter season's temperature



December-
February



Pure line Exotic Carp Introduced in BFRI for Quality seed production & Genetic research

Species	Common name	Source	Year of introduction
<i>Ctenopharyngodon idellus</i>	Grass carp	China	2010
<i>Mylopharyngodon piceus</i>	Black carp	China	2010
<i>Hypophthalmichthyes molitrix</i>	Silver carp	China	2010
<i>Aristichthys nobilis</i>	Bighead carp	China	2010
<i>Carassius carassius</i>	Crucian carp	China	2011
<i>Pangasianodon hypophthalmas</i>	Thai Pangas	Thailand	2010, 2011

Quality seed production & distribution by BFRI

- Every year BFRI have been producing **quality breeds** & distributing to the fish farmers, nursery & hatchery owners.



Quality seed production & distribution by BFRI-FS Hatchery (2009-2013)

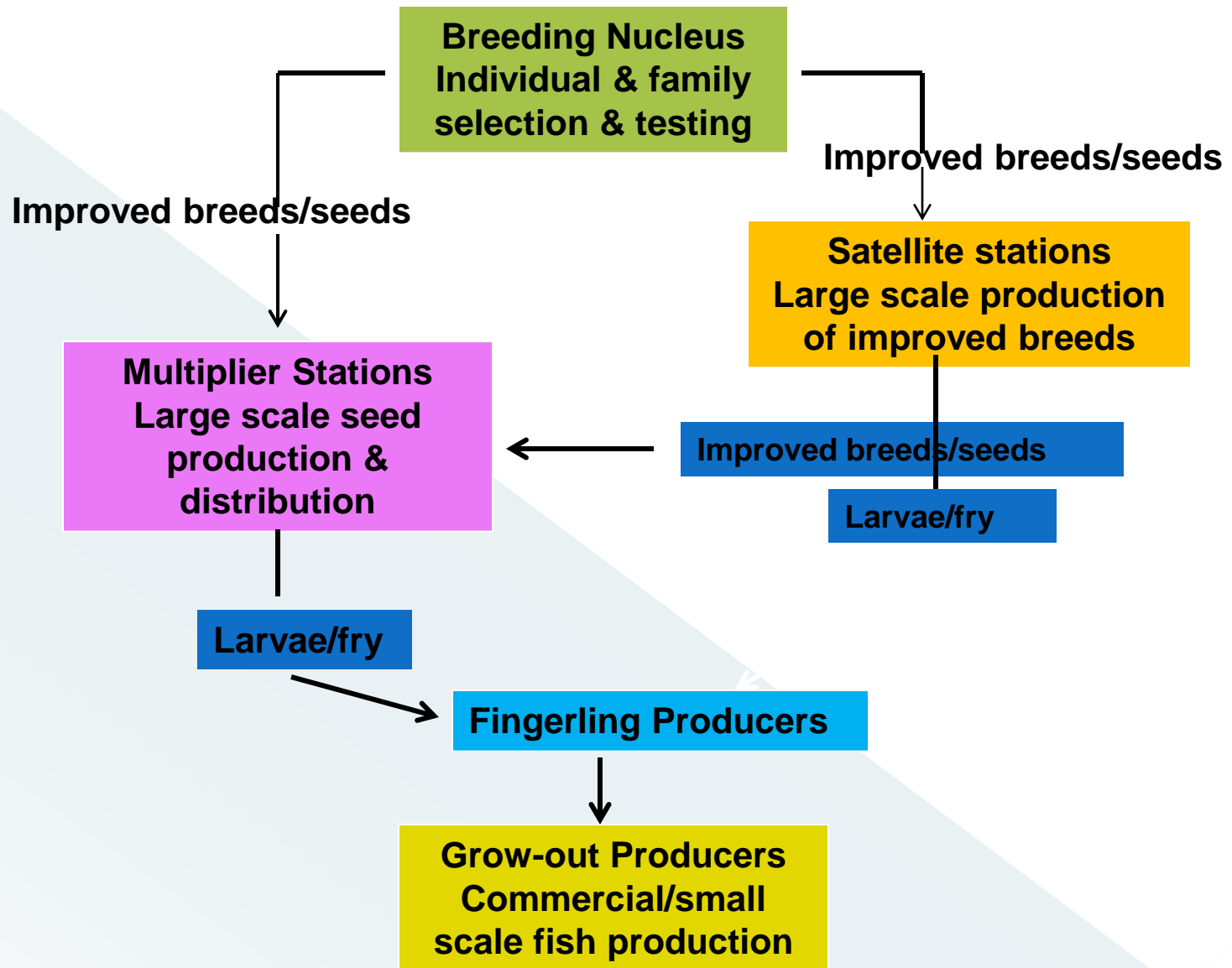
Species	Year	Quantity of Spawn (kg)	Estimated fingerling (million)	Farmer's Comments
BFRI Rohu, BFRI Rajpunti, Catla (Halda, Jamuna), Mrigal (Halda, Jamuna), Common Carp (Vietnam), Silver & Bighead carp	2009	275	82.50	✓ Higher growth ✓ Higher survival ✓ Huge demands ✓ Need more & more production?
	2010	295	88.50	
	2011	320	96.00	
	2012	345	103.5	
	2013 (Target)	400	112.00	

Quality seed production & distribution by BFRI-FS Hatchery (2009-2013)

Species	Year	Fry (million)	Farmer's Comments
BFRI GIFT	2009	0.5	<ul style="list-style-type: none"> ✓ Higher growth ✓ Higher survival ✓ Huge demands ✓ Need more & more production?
	2010	1.20	
	2011	1.50	
	2012	1.95	
	2013	2.50	

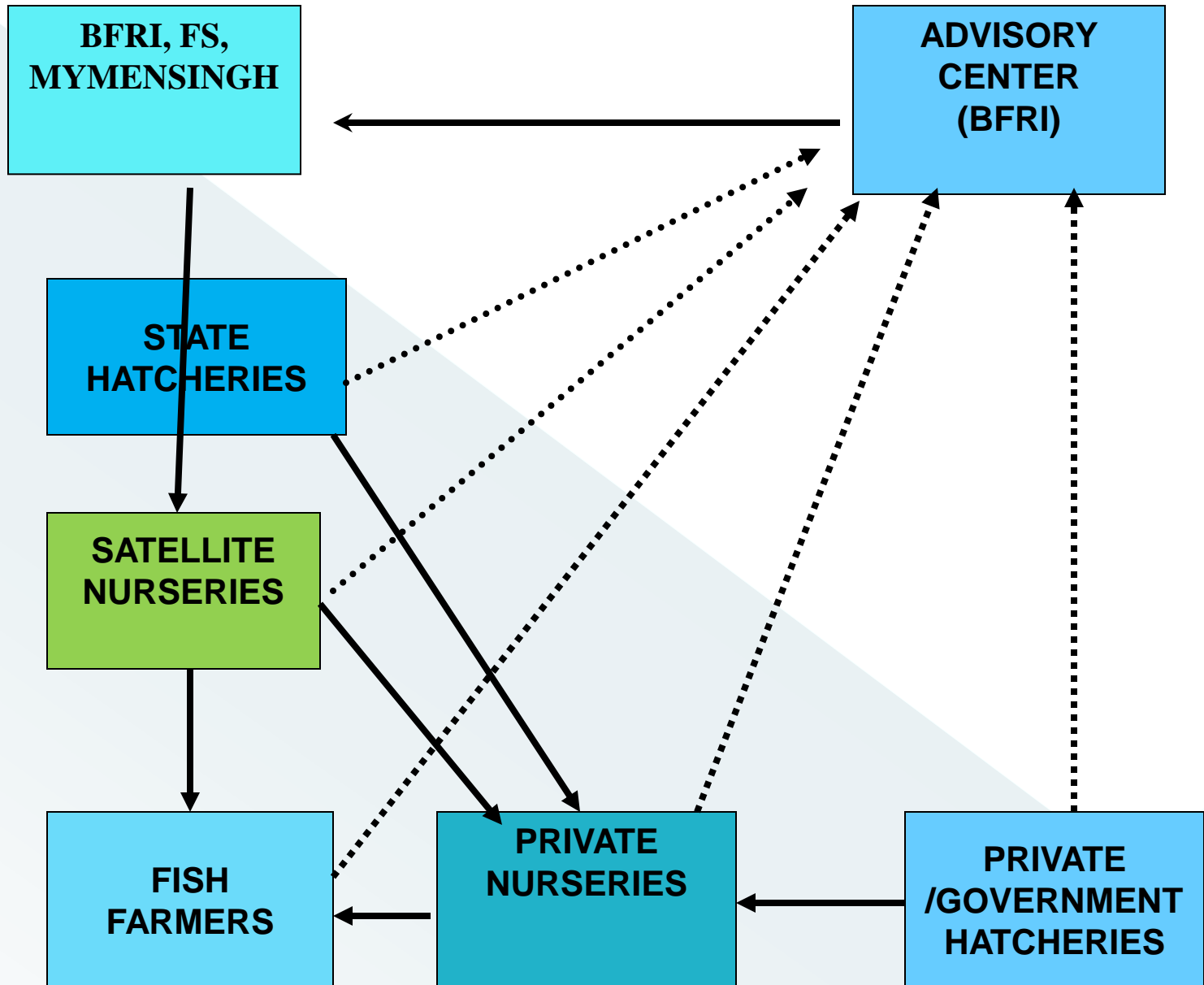
Note: About 150 Tilapia hatcheries maintained BFRI GIFT for quality seed production.

*Dissemination Channel of
Improved Quality Seeds*



A schematic model for dissemination of improved fish breeds in Bangladesh

Dissemination Program for Improved Seeds to the Beneficiaries



Genetic Research for Quality Seed

Future Genetic Research Plan for Quality Seed Production

- ❑ Collection of pure strain from suitable countries & improvement of existing germplasm
- ❑ Development of markers assisted selective breeding techniques
- ❑ Identification of Quantitative Trait Loci (QTLs) using different molecular markers
- ❑ Initiation of genetic stock improvement program using best stock as base population through application of selective breeding and line crossing techniques
- ❑ Development of cryogenic gene banking for facilitating the artificial breeding of carp as well as conservation of improved stocks
- ❑ Continuation of stock improvement program and dissemination of improved germplasm among private and government hatchery operators
- ❑ Establishment of brood bank with pure strain of carp species is of prime importance for Bangladesh

Recommendations

The establishment of centre for conservation & improvement of fish **Genetic Resources Bank** should be maintained at **DoF** with the involvement of **BFRI** & where from improved germplasm will be supplied to selected public & private hatcheries for the quality seeds production & dissemination to the farmers

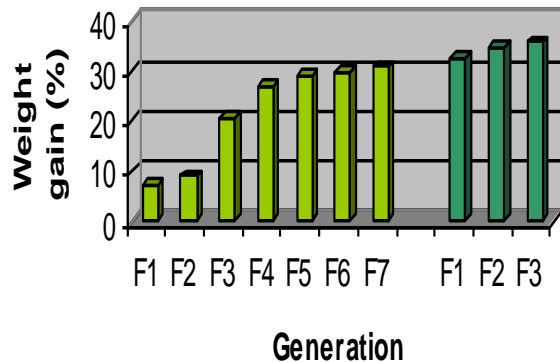
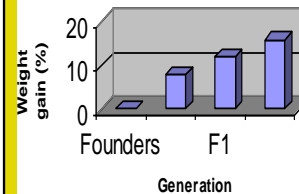


Figure 2. Genetic weight gain (%) in consecutive generations of selected groups over control groups in silver barb



Genetic weight gain in consecutive generations through mass selection of Rofu compared to non-selected control and local stock of Mymensingh



Thanks

