

Fig. 13 Gross fish production from different drug treated pond

9.5.25 Net fish production

After using of drugs the mean (\pm SD) values of net fish production were recorded as 1955.64 ± 24.28 kg/ha, 1501.14 ± 47.66 kg/ha, 1455.12 ± 61.94 kg/ha and 1500.50 ± 30.11 in Timsen, Geo-fresh, Geo-prime and Geo-tox treated ponds, respectively (Fig. 14).

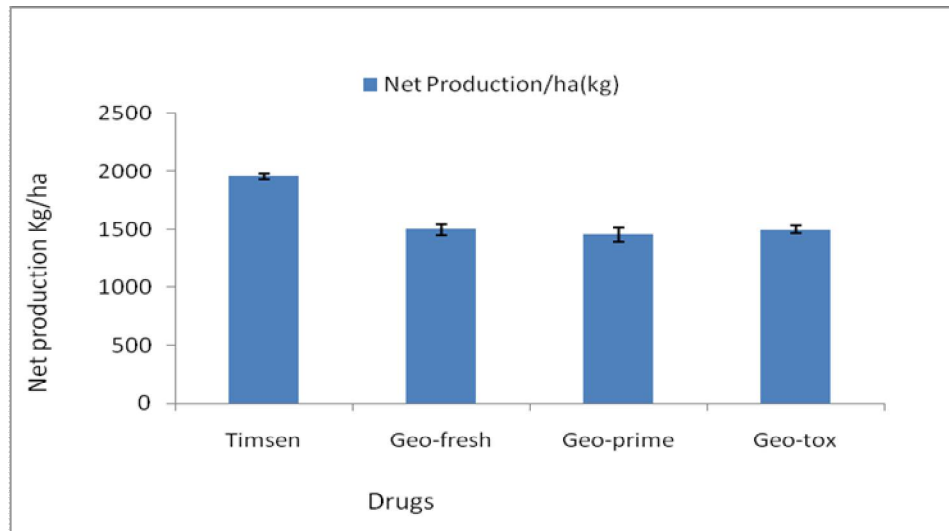


Fig 14 Net fish production from different drug treated pond

9.5.26 Survival

After using drug the mean (\pm SD) values of survival of fish were recorded as 85.00 ± 1.73 , 77.00 ± 2.00 , 75.67 ± 1.53 , 79.00 ± 1.00 in Timsen, Geo-fresh, Geo-prime and Geo-tox treated ponds, respectively (Fig. 15).

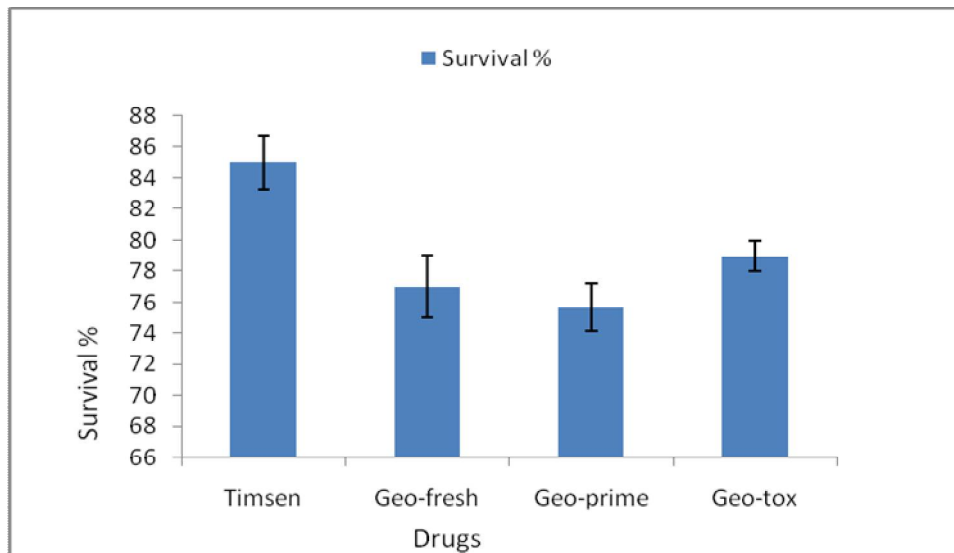


Fig. 15 Survival of fish in different drug treated pond

9.5.27 Histopathological study of different organs of *O. niloticus*

Different organs of *O. niloticus* such as liver, gill, muscle and kidney were observed by histological study to identify the effects of drugs and chemicals. Histological study did not show any change of the following organs (Figs. 16-19), so drugs had no negative impact on different organs of *O. niloticus*.

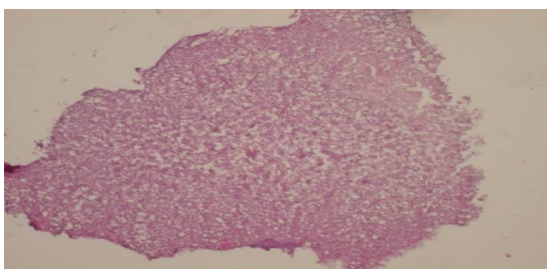


Fig. 16 Liver

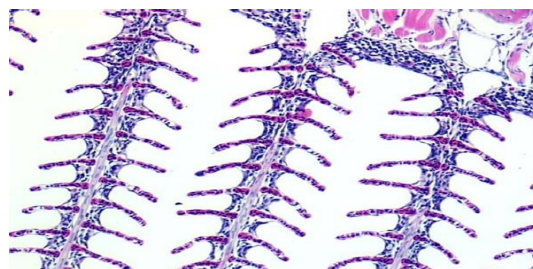


Fig. 17 Gill

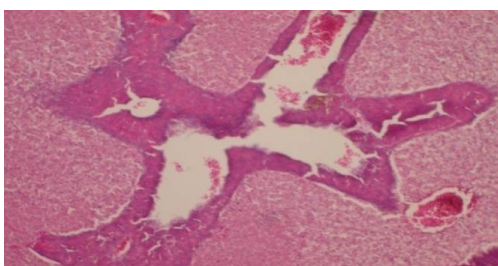


Fig. 18 Kidney

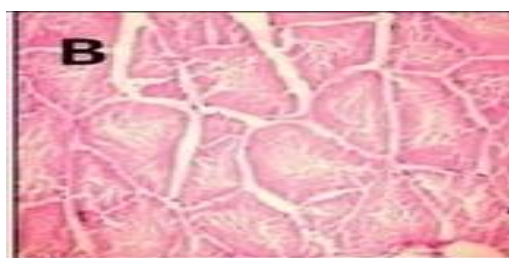


Fig. 19 Muscle

The research was conducted for a period of 120 days from August to November 2012 in 12 ponds, each with an area 40 m². The research was done to determine the efficacy of selected common drugs used in Bangladesh. For enhancing production of GIFT, Timsen, Geofersh, Geoprime, Geotox, were selected to apply for maintaining water quality of the ponds. The experiment was designed into four treatment groups of T₁ -(Timsen), T₂ -(Geofersh), T₃ -(Geoprime) and T₄ -(Geotox), each having 100 fingerlings, equally divided into three replications. Male GIFT, (ABW: 6.25 ± 0.27 g) fingerlings were used as test fish. Feeding of the fingerling was done twice daily in the morning and evening with commercial nursery feed (Saudi-Bangla Fish Feed Limited) at the rate of 10% of the body weight at first week. For second week daily ration was adjusted at the rate of 5% of the body weight. Data on water quality parameters was recorded both before and after drug application and survivality and growth were recorded after using drugs. Essential water quality parameters were recorded weekly and growth, survivality were recorded after ten days interval. Histological studies were done one month's interval.

After using drugs, suitable value of pH (8.12±0.58), alkalinity (119.40±9.67), nitrate (0.28±0.04), phosphate (1.00±0.19) and dissolved oxygen (4.56 ± 0.29), were observed in all treatments. Ammonia became reduced due to use of drugs. During observation of

physical water quality parameters transparency (31.27 ± 3.06) became increased and temperature (28.25 ± 3.38) became lower than the control one. GIFT production was higher in Timsen treated pond than other drug treated ponds. Histopathological study did not show any negative changes on the organ of fishes. Among the drugs applied, Timsen was proved best in all aspects as it improves fish health and water quality. Other three drugs (Geo-tox, Geo-fresh, and Geo-prime) showed more or less same results.

9.6 Determination of efficacy of selected oxygen releaser drugs used in aquaculture

Study Area

Three experiments were conducted; one in Laboratory condition, one in on-station experimental pond of the Freshwater Station and other one is in farmer's pond of Trishal, Muktagachha and Fulpur Upazilla.

9.6.1 Experiment-1: Impact of oxygen releaser in controlled condition

This experiment was conducted in 15 plastic buckets. The size of buckets was 30 liter. Five selective drugs were tested and each had three replications. Before using drugs, initial concentration of DO of pond water was recorded. After that oxygold, oxymore, oxymax, oxyflow and oxylife were applied at different doses. Data were recorded simultaneously at 30 min., 60 min., 120 min., 180 min. and 240 min. interval for each drug (Table 21). It was observed that concentration of dissolved oxygen was initially increased and later gradually decreased in successive hours.

Table 21 Impact of Oxygen releaser under control condition

Name of drugs	Initial level of O ₂ (ppm)	After 30 min.levels of O ₂ (ppm)	After 60 min. levels of O ₂ (ppm)	After 120 min. levels of O ₂ (ppm)	After 180 min. level O ₂ (ppm)	After 240 min. level O ₂ (ppm)
Oxygold	1.83± 0.05	3.17± 0.15	4.77± 0.55	3.77± 0.55	3.77± 0.55	2.97± 0.45
Oxymore	1.83± 0.05	2.63± 0.65	4.53± 0.45	3.63± 0.45	3.63± 0.45	2.43± 0.35
Oxymax	1.83± 0.05	2.88± 0.34	4.58± 0.64	3.88± 0.34	3.28± 0.34	2.85± 0.34
oxylife	1.83± 0.05	3.23± 0.85	4.70± 0.85	3.73± 0.75	3.73± 0.75	2.34 0.75
Oxyflow	1.83± 0.05	3.23± 0.55	4.62± 0.73	3.63± 0.73	3.63± 0.73	2.79± 0.73

9.6.2 Experiment-2: Impact of oxygen releaser in pond condition

9.6.3 Materials and Methods

To determine the effect of oxygen releasing drugs, an experiment was conducted in the earthen ponds of the BFRI, Mymensingh from the period of August-October 2011. Twelve ponds having an area of 40 m² (1decimal=40.48 m²) each were prepared through sun drying and liming the bottom soil with agricultural lime @ 250 kg/ha and mustard oil cake @ 500 kg/ha. The ponds were filled in with underground water up to a depth of 1 m and inorganic fertilizers of TSP and urea were applied @ 35 kg/h with 3:1 ratio.

After 5 days of fertilization, *O. niloticus* fry (ABW: 3.33 g, ABL: 5.53±0.83 cm), were stocked in the ponds with same stocking patterns of 100 fish/pond. The experiment was designed with three different doses of drugs (T₁: Recommended dose, T₂: 1.5 times lower than recommended dose and T₃: 1.5 times higher than recommended dose). Each treatment had three replications and those were assigned into a completely randomized design. Five selective drugs were tested and each had three replications. Before and after using drugs (30 minutes, 60 minutes, 120 minutes, 180 minutes and 240 minutes) data were recorded simultaneously. It was observed that concentration of dissolved oxygen was increased at first and gradually decreased in all the treatments (Table 22-26).

Table 22 Mean values of different water quality parameters of ponds under three treatments (Before using drugs)

water quality parameters	T ₁ (RD)	T ₂ (1.5 times LD)	T ₃ (1.5 times HD)	T ₄ (Control)
Temp. (°C)	30.23 ± 2.15	30.38 ± 2.58	30.43 ± 2.15	30.53 ± 2.18
DO (mg/L)	4.65 ± 0.91	4.35 ± 0.78	4.78 ± 0.88	4.35 ± 0.94
PH	6.5-7.14	6.27-7.18	6.22-7.62	6.28-8.11
Total Alka. (mg/L)	116.35 ± 6.25	115.65 ± 8.78	114.00 ± 12.38	124.75 ± 12.34
Ammonia (mg/L)	0.65 ± 0.09	0.52 ± 0.08	0.41 ± 0.08	0.85 ± 0.05

Table 23 Mean values of different water quality parameters of ponds under three treatments (After using drugs)

water quality parameters	T ₁ (RD)	T ₂ (1.5 times LD)	T ₃ (1.5 times HD)	T ₄ (Control)
Temp. (°C)	32.26 ± 3.15	32.28 ± 2.58	32.43 ± 2.13	32.53 ± 2.15
DO (mg/L)	6.85 ± 0.91	5.65 ± 0.78	8.88 ± 0.98	4.75 ± 0.94
P ^H	7.5-8.11	7.37-7.69	7.82-8.62	7.98-8.11
Total Alkalinity (mg/L)	196.85 ± 16.25	165.65 ± 8.78	214.00 ± 12.38	174.75 ± 12.34
Ammonia (mg/L)	0.22 ± 0.19	0.22 ± 0.04	0.24 ± 0.03	0.28 ± 0.15

Table 24 Oxygen concentration of different drugs in laboratory condition

Name of drugs	Initial level of O ₂ (ppm)	After 30 min. Levels of O ₂ (ppm)	After 60 min. levels of O ₂ (ppm)	After 120 min. levels of O ₂ (ppm)	After 180 min. level O ₂ (ppm)	After 240 min. level O ₂ (ppm)
Oxygold	1.83± 0.05	3.17± 0.15	4.77± 0.55	3.77± 0.55	3.77± 0.55	2.97± 0.45
Oxymore	1.83± 0.05	2.63± 0.65	4.53± 0.45	3.63± 0.45	3.63± 0.45	2.43± 0.35
Oxymax	1.83± 0.05	2.88± 0.34	4.58± 0.64	3.88± 0.34	3.28± 0.34	2.85± 0.34
oxylife	1.83± 0.05	3.23± 0.85	4.70± 0.85	3.73± 0.75	3.73± 0.75	2.34 0.75
Oxyflow	1.83± 0.05	3.23± 0.55	4.62± 0.73	3.63± 0.73	3.63± 0.73	2.79± 0.73

Table 25 Mean values of different water quality parameters of ponds under four treatments (Before using drug)

Water quality parameters	T ₁ (RD)	T ₂ (1.5 times LD)	T ₃ (1.5 times HD)	T ₄ (Control)
Temp. (°C)	30.23 ± 2.15	30.38 ± 2.58	30.43 ± 2.15	30.53 ± 2.18
DO (mg/L)	4.65 ± 0.91	4.35 ± 0.78	4.78 ± 0.88	4.35 ± 0.94
PH	6.5-7.14	6.27-7.18	6.22-7.62	6.28-8.11
Total Alka. (mg/L)	116.35 ± 6.25	115.65 ± 8.78	114.00 ± 12.38	124.75 ± 12.34
Ammonia (mg/L)	0.65 ± 0.09	0.52 ± 0.08	0.41 ± 0.08	0.85 ± 0.05

Table 26 Mean values of different water quality parameters of ponds under four treatments (After using drugs)

Water quality parameters	T ₁ (RD)	T ₂ (1.5 times LD)	T ₃ (1.5 times HD)	T ₄ (Control)
Temp. (°C)	32.26 ± 3.15	32.28 ± 2.58	32.43 ± 2.13	32.53 ± 2.15
DO (mg/L)	6.85 ± 0.91	5.65 ± 0.78	8.88 ± 0.98	4.75 ± 0.94
P ^H	7.5-8.11	7.37-7.69	7.82-8.62	7.98-8.11
Total Alka. (mg/L)	196.85 ± 16.25	165.65 ± 8.78	214.00 ± 12.38	174.75 ± 12.34
Ammonia (mg/L)	0.22 ± 0.19	0.22 ± 0.04	0.24 ± 0.03	0.28 ± 0.15

RD = Recommended dose, LD= Lower dose, HD= Higher dose

9.6.4 Plankton determination

During the trial period, total phytoplankton population was higher in T-3 than that of T₁ and T₂. The mean abundance of total phytoplankton was $10.67 \pm 2.06 \times 10^3$, $7.15 \pm 1.4 \times 10^3$ and $20.28 \pm 2.06 \times 10^3$ cells/L in T₁, T₂ and T₃, respectively (Table 27). In T₃, 50.22% higher phytoplankton population was produced where pond was treated by higher (1.5 times) dose. The mean abundance of total zooplankton population was found to be $2.64 \pm 0.22 \times 10^3$, $1.71 \pm 0.31 \times 10^3$ and $5.22 \pm 2.16 \times 10^3$, unit/L in T₁, T₂ and T₃, respectively. The zooplankton concentration of T₃ was higher than that of T₁, where recommended dose was applied.

Table 27 Mean abundance of plankton ($\times 10^3$ cells/l) in ponds under three treatments

Plankton group	T ₁ (Recommended dose)	T ₂ (1.5 times lower dose)	T ₃ (1.5 times higher dose)
Phytoplankton	$10.67 \pm 2.06 \times 10^3$	$7.15 \pm 1.4 \times 10^3$	$20.28 \pm 2.06 \times 10^3$
Zooplankton	$2.64 \pm 0.22 \times 10^3$	$1.71 \pm 0.31 \times 10^3$	$5.22 \pm 2.16 \times 10^3$

Production of phytoplankton and zooplankton was higher in the T₃, where 1.5 higher dose was applied than that of recommended dose.

9.6.5 Experiment-3: Impact of oxygen releaser drugs in farmer's pond

In Mymensingh regions Thai pangas, Thai Koi, Tilapia, Magur and Shing are cultured intensively. Production of Pangas and koi in Tarakanda and Muktagachha upazillas were almost double in the chemical treated ponds compared with non treated ponds (Table 28).

Table 28 Culture of fish by using drugs in different Upazillas of Mymensingh district

Site	Pond size (decimal)	Species culture	Stocking density/dec	Before drug use (O ₂ mg/L)	Recommend dose (O ₂ mg/L)
Trishal	42	Pangas Silver Rui Catla Carpio	238	4.64 ± 0.67	7.36 ± 0.36
Muktagachha	38	Shing pangas silver	450	5.64 ± 0.67	8.24 ± 0.67
Tarakanda	40	Tilapia Shing Magur	860	3.84 ± 0.27	6.94 ± 0.68

9.5.6 Analysis

Fish production between culture systems using chemicals and without chemicals were compared. Ponds from three Upazillas like Trishal, Muktagachha and Tarakanda were selected. For this purpose, carp polyculture with Thai pangas, Shing, Magur and tilapia were chosen and total fish production and water quality were determined from the ponds using chemical and without chemicals. Production of fish was slightly higher in the treated pond (Oxygen releaser drug) than that of non-treated pond.

9.5.7 Conclusion

From the findings it could be suggested that 1.5 times higher dose than recommended dose of each drug have been optimized for increasing dissolved oxygen in critical event. However elaborate studies are necessary to observe the effects of oxygen releaser drugs and others with more bio-chemical parameters before making comments.

It was observed that concentration of dissolved oxygen was initially increased and later gradually decreased in successive hours.

Histological observation of different organs of fish shows no remarkable changes after using drugs.