



A case of hydrated lime (Caoh)₂ toxicity in *Clarias gariepinus* juveniles

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Abstract

A sudden increase in mortality was observed in a fish pond stocked with 1034 6-weeks old *Clarias* juveniles, after exhibiting various forms of nervous disorders such as severe irritation and erratic convulsive swimming habits. A total of 165 mortality, with mean of 20.6 ± 14.8 /day were recorded within the first week of stocking. A perfect positive correlation of water level in the pond $R^2 = 0.92$, with inverse mortality $R^2 = 0.14$ and pH values $R^2 = 0.78$ within the first 8 days were recorded. Carcasses exhibited various forms of skin discoloration, petechial and ecchymotic hemorrhages were observed on the cranium, base of the fins, body sides and bloated belly. Many carcasses had eroded body mucous, manifested by various forms of grayish bands of skin lesion. Mean optimal values for nitrate (0,mg/litre), nitrite (0.1,mg/litre) and ammonia (0.1mg/litre) in the water were recorded using commercial multiple water testing kit, although declining pH value of 11 to 7.5 was observed within the period. Another set of 200 *Clarias juveniles* of the same batch was raised in an adjacent pond, and appeared clinically healthy. Spontaneous recovery was observed upon transfer of the whole juveniles to a new pond of fresh water, with mean pH 7.5 and treated with oxytetracycline and vitamin-mineral supplements. Diagnosis of acute lime toxicity was made. Normal growth was restored but, evidence of necrotic skin discoloration was retained to adulthood in 20% of the fishes.

Keywords: *Clarias gariepinus* juveniles, hydrated lime, toxicity

Introduction:

Fish production through aquaculture has great potential in poverty eradication and alleviating malnutrition in Nigeria. As a cheap source of high quality animal protein (16 -20%), it has comparative advantage over poultry eggs and milk (Nayaya, 1999). Fish industry therefore is promising in fulfilling the mandate of the Millennium Development goals towards 2015. With digestibility rating of 94 (NRC, 1989) and Biological Value of 75, fish proteins are comparable to red meat and indeed superior to plant proteins (McDonald, 2010).

Application of lime to fish ponds has now become a cultural practice by farmers to get rid of external parasites and other pathogens and considered as excellent pond disinfectant (NIFFR, 2001). Quicklime, slaked or Hydrated lime and Agricultural lime if properly applied to fish ponds have advantages of increasing the alkalinity of acidic soil, increasing pond biological productivity and neutralizing the harmful effects of magnesium, sodium and potassium salts (FAO, 2010).

Case report

Case history

A case of sudden and increasing mortality, was reported to a field Veterinarian at Rugga settlement, 3 days post-stocking in an artisanal fish pond accommodating 1034, 6- weeks old *Clarias gariepinus* juveniles. Two farmers purchased and shared 1234 6- weeks old juveniles from Abuja fish market as replacement stock to restock their respective ponds.

Farmer A, had 1034 in artisanal pond measuring 7 x 3 x 1 metres, while farmer B had 200 juveniles in concrete pond; measuring 2 x 2 x 1 metres, and commenced management and feeding with 2mm Coppens commercial fish feed. Farmer A, lost 165 juveniles within the first week of introduction with nervous and abnormal swimming habits exhibited, while no losses were incurred by neighboring farmer B. History further revealed that farmer A, claimed to have disinfected his pond by side application of Agricultural lime (1kg) purchased from Abuja fish market, and allowed the pond to refill to one meter level prior to restocking.

Clinical assessment

The following behavioral signs were exhibited by most of the fishes; flashing, jumping, hanging, skittering on the surface with uncoordinated swimming pattern, varying degree of skin discoloration (Plates 1 and 2), loss of righting reflex and sluggish movement for others shortly before death. Appetite was normal. Postmortem lesions reveals; hyperemic patches on the head region presenting a marbled appearance, petechial and eccymotic hemorrhages at the base of the fins and belly, sudden bloating and rapid decomposition of carcasses. Few cases had grayish bands around the head and body parts.

Rapid field screening tests for water qualities were conducted for pH, nitrate, nitrite and ammonia. Results were within normal limits for all parameters except pH, which was high on the first day and gradually reducing to 7.8 by the fourth day (Table 1). Water temperature ranged between 21°C in the morning to 23°C at about afternoon. Water lilies that were introduced initially to serve as shade, turned yellowish (Plate III).

A diagonal bottom mud sampling for pH values was adopted to ascertain the level of uniformity or otherwise of lime application in the pond.

Representative samples were diluted with pond water before analysis with pH meter.

Diagnosis and management

Hydrated lime toxicity was diagnosed. In managing the case, the surviving juveniles (Plate 1) were transferred to a fresh pond, and prophylactically treated with broad spectrum antibiotic (oxytetracycline/neomycin) and vitamin supplement incorporated in feed at the rate of 10mg/kg for 3 days. Spontaneous recovery was recorded the following week.

Result and Discussion

From the history of lime application, the dosage of one kg per pond of 7 x 3 x 1, metres and descending pH within the first 8 days (Table 1), lime toxicosis was suspected.

Liming fishponds with either agricultural lime (CaCO₃), Slaked lime (CaOH₂), or Quicklime CaO at recommended doses serve as excellent pond disinfectant (NIFFR, 2001), helps to increase soil alkalinity, eliminate pathogens, parasites, and invertebrate predators, while waiting period of 1 – 2 weeks be allowed for pH to stabilize to 6.5-8.0 before refill (Haruna, 2003).



Plate I: Surviving Fishes with numerous marbled hemorrhagic and necrotic patches



Plate II: An infected fish showing gray band of skin discoloration



Plate III: A fish with Eroded mucous and skin discoloration

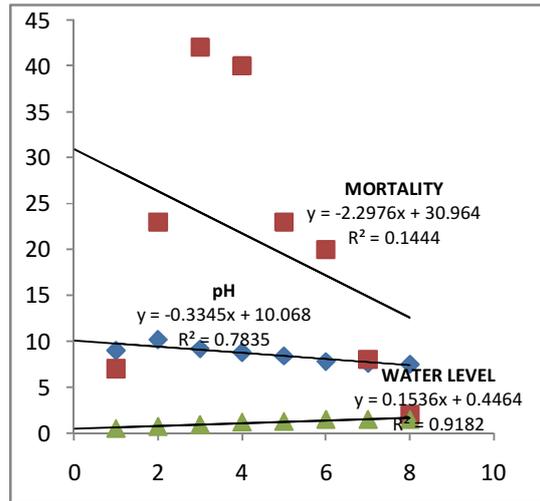


Figure 1: Correlation of 3 Variables in the pond of affected Clarias juvenile: Water level, pH, and Fish Mortality

Table 1: Water level, Mean PH and Fish Mortality for the 8-days period of study

pH	Mortality (Number)	Water level (m)
9	7	0.5
10.2	23	0.7
9.2	42	0.9
8.8	40	1.2
8.4	23	1.3
7.8	20	1.5
7.6	8	1.5
7.5	2	1.5

Hydrated lime CaOH_2 or Quicklime at alkalinity levels of 100mg/l to 200mg/l is ideal and considered as sterilant, giving a pH of about 11 and invariably kill everything. Ponds should therefore not be stocked until the pH returns to acceptable levels Francis-floyd, (1993). Application of lime by the side of the pond as reported here, could promote uneven settlement at the bottom, and hence the variable pH values obtained within the pond. The characteristic feeding habit of Clarias and its tendency to burrow under the mud, could account for the adverse burning and other disastrous nervous signs exhibited shortly before death.

Though lime has irritating effect on skin and eyes on cattle grazing on limed pastures (Edward 2002), it has beneficial effect of reversing arsenic toxicity in catfish ponds (Hameid, 2009). As part of the general hints on disease prevention and control, NIFFR (2001), recommend quicklime for disinfecting fish ponds at 100-200 kg/ha. It is obvious therefore that the farmer ignorantly misapplied the lime at exceedingly high dose level.

The apparent hyperemic appearance (Plate 1) could be attributed to adverse skin inflammatory reaction, hence loss of usual dark body coloration and depigmentation

with numerous petechial hemorrhage. The effect persisted and is seen as necrotic patches even at adulthood. They hemorrhagic patches on various parts of the body are equally characteristic of infection due to *Aeromonas salmonocida* while inflamed cloudy skin with extensive body slime (Plate 3), is due extreme fluctuation in pH as previously reported (NFP, 2010) and this equally conforms to lime toxicity.

Though rapid multiple water testing kit Interpet-2010 (Easy test), was used to measure the levels of nitrate, nitrite, ammonia and pH, a digital pH meter was equally used for confirmation and precise measurement of pH values.

From the graphical presentation of 8 days pond records (Figure 1), the variables of pH, mortality and Water level were correlated. An inverse relationship could be seen, as water level in the pond increases steadily with perfect correlation ($R^2 = 0.9182$), while pH value decreases, over time ($R^2=0.7835$) as the lime was diluted and similarly as high pH values were recorded in the first 2 days high mortality was observed within the period under review, a total of 165 Juveniles died, with the mean daily records of 20.6 ± 14.8 deaths and had an inverse weak correlation ($R^2=0.1444$) with water level in the pond.

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