

Duckweed Control Using Fluridone in Sequential Treatments



A Summary Report to Delta Wings Hunting Club

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INTRODUCTION

Common duckweed (*Lemna minor* L.) (here after referred to as duckweed) is a floating aquatic plant that can cause severe nuisance problems in water bodies throughout the United States. Despite duckweed being a native plant, its invasive growth can cause severe environmental problems as well as aesthetic problems, such as impeding navigation, reduce plant diversity, and deplete dissolved oxygen which can lead to a reduction in fish productivity (Parr et al. 2002). Duckweed infestations are typically prescribed two aquatic herbicides, diquat and or fluridone.

Diquat [(6,7-dihydrodipyrido (1,2-a:2',1'-c) pyrazinedium dibromide)] is often the prescribed herbicide for control of duckweed; however, it has at times been inconsistent in effectiveness. Previous studies have shown diquat to be an effective herbicide against duckweed infestations at both small laboratory scales as well as pond and lake scales (Berry and Schreck 1975, Blackburn and Weldon 1965, Langeland et al. 2002, Peterson et al. 1999). Fluridone [(1-methyl-3-phenyl-5-[3-trifluoromethyl]phenyl)-4(1*H*)-pyridinone)] is another commonly prescribed herbicide for duckweed control. Fluridone has been demonstrated to provide excellent control of duckweed in early screening trials with rates as low as 0.03 part per million (ppm) achieving 100 percent control eight weeks after treatment (McCowen et al. 1979).

While there is lab and controlled outdoor experiments of fluridone use for control of duckweed (McCowen et al. 1979), no publications are available to describe the efficacy of fluridone on duckweed under operational conditions. The objective of this study is to demonstrate the effectiveness of using fluridone to control duckweed at the pond scale.

MATERIALS AND METHODS

The study was conducted on a 10.8 acre lake in Holcomb, Mississippi with an average depth of 5.7 ft. The study began in May 2007 and continued through September 2007. The lake was 67% covered two weeks prior to treatment with duckweed; however, at the time of treatment there was a 100% cover of duckweed throughout the 10.8 acre lake (Figure 1). Fluridone (as Avast® Aquatic Herbicide, SePRO Corporation 11550 North Meridian Street, Suite 600, Carmel, IN 46032) was applied at a total rate of 90 parts per billion (ppb) to the entire lake, split over two treatments; a 50 ppb initial treatment followed by a 40 ppb treatment one month later. The application was delivered using a 10 foot john boat outfitted with a sub-surface injection system calibrated to 20 gal/acre. A lower delivery volume for the treatment was used because of debris in the water column and the need to avoid exceeding the labeled rate for a particular area. Biomass was collected using a 2 in. (0.002 m²) PVC harvesting tool developed specifically for duckweed and similar species. Biomass was collected 30 and 120 days after treatment (DAT). Biomass samples were dried at 158°F to obtain a constant mass and weighed to determine post treatment biomass. Data was analyzed using a mixed model ANOVA with repeated measures. The analysis was conducted at the p= 0.05 level of significance using SAS (SAS Institute 2002).

RESULTS AND DISCUSSION

Duckweed was highly susceptible to fluridone throughout the entire study. One month (30 DAT) following the 50 ppb initial treatment, duckweed biomass was reduced from 47.0 to 0.4 g DW m⁻² ($p < 0.001$) (Figure 2, 3). Duckweed biomass was reduced even further at 120 DAT from 0.4 to 0 g DW m⁻²; however this reduction was not significantly different from the 30 DAT biomass ($p=0.9577$) (Table 1). Biomass was significantly reduced from the pre-treatment assessment to the 120 DAT, from 47.0 to 0 g DW m⁻² ($p < 0.001$) (Figure 2). Fluridone resulted in a 100% control of duckweed from the pond (Figure 4). Our results coincide with results found in laboratory screenings of duckweed control using fluridone (McCowen et al. 1979). The efficacy of fluridone may be due to the unique characteristics of this herbicide in combination with the nutrient uptake of duckweed. Fluridone is a slow acting herbicide and commonly requires 60 to 90 days of contact time to achieve acceptable control in submersed plants (Netherland et al. 1993, Netherland and Getsinger 1995). This longer contact time, combined with duckweeds ability to uptake nutrients not only from the water column (Ice and Couch 1987) and from the upper surface of the frond (Meijer and Sutton 1987), allows for thorough uptake of fluridone from the pond.

Results from this study indicate that duckweed can be controlled by fluridone applied using a subsurface application. Sequential applications of fluridone did not significantly differ in reduction of biomass. However, the second treatment of 40 ppb may have contributed to maintaining a lethal amount of fluridone in the system to continue controlling any new duckweed fronds that may have been formed during the study. Continued management of duckweed may be done with either fluridone or diquat. Selection of diquat versus fluridone for duckweed control may depend on the price of the available products and the relative amount of infestation. Diquat has been proven to adequately control duckweed as a foliar or subsurface application and can be done with ease and equipment that is already available to Delta Wings Hunting Club.

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Table 1. The results of the mixed procedures ANOVA model with repeated measures.

Effect	Survey	T Value	P Value
Survey	Pre x 30 DAT	7.06	< 0.0001
Survey	Pre x 120 DAT	7.12	< 0.0001
Survey	30 DAT x 120 DAT	0.05	0.9577



Figure 1. Duckweed (*Lemna minor*) infestation at Delta Wings Hunting Club prior to fluridone treatments.

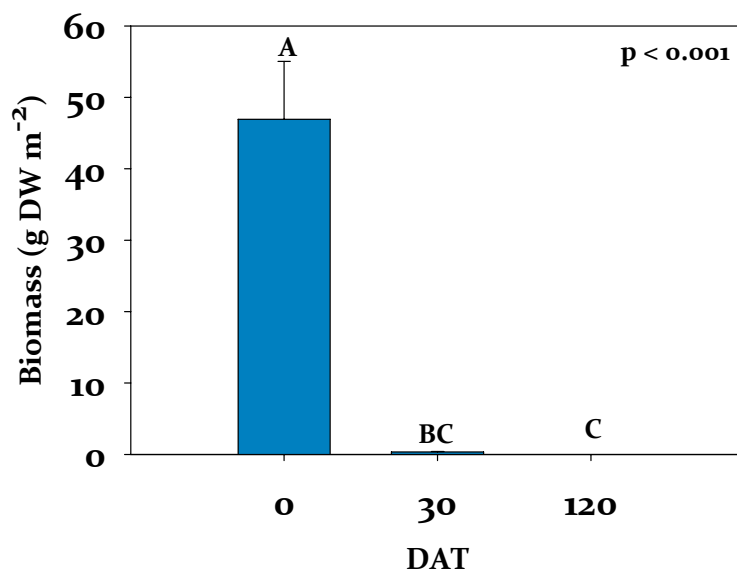


Figure 2. Mean biomass (± 1 SE) of duckweed (*Lemna minor*) harvested Pre-treatment, 30 DAT, and 120 DAT with subsurface applications of fluridone.



Figure 3. Duckweed (*Lemna minor*) at 30 DAT.



Figure 4. Duckweed (*Lemna minor*) at 120 DAT.