AQ200 AS AN AQUATIC HERBICIDE TO TREAT FREE-FLOATING AQUATIC WEEDS

Literature Review

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OVERVIEW

- This literature review explores the use of AQ200, a broad-spectrum aquatic contact herbicide, as a foliar spray for treating free-floating aquatic weeds in dams, lakes, ponds, etc.
- AQ200 is the only viable treatment method apart from large-scale mechanical removal when dealing with multilayered free-floating aquatic weed infestations of duckweed, azolla, salvinia, etc.
- AQ200 acts by preventing aquatic weed cells from carrying out photosynthesis, causing them to shrivel and die.
- AQ200 is safe to use in drinking water as it disappears within 1–10 days after treatment.
- AQ200 is ideal for use in irrigation, livestock watering and drinking water as its active ingredient meets the WHO guidelines for water safety.
- AQ200 has a low ecological risk as it does not bioaccumulate, and has a negligible risk on non-target aquatic organisms such as fish, birds, invertebrates and amphibians.

INTRODUCTION

While aquatic plants are a fundamental element of any aquatic ecosystem, their unchecked growth can have many negative impacts on waterbodies. The eutrophication of waterbodies by human impacts has led to increased occurrences of aquatic weed infestations. Particular aquatic weed species, including many free-floating aquatic weed species, are also more capable at competing for natural resources than others. This, combined with their exceptionally fast growth rates, is why a handful of species are responsible for the majority of aquatic weed infestations. Aquatic weeds have negative effects on aquatic wildlife and reduce the overall health of the waterbody. They also limit uses of the waterbody by reducing access to drinking water, interfering with pumps for irrigation, interfering with fishing equipment, etc. Therefore, the need to control aquatic weeds safely and effectively is of utmost importance.

IMPACTS OF FREE-FLOATING AQUATIC WEEDS

Environmental	▪ Out-competes with desirable aquatic plants for resources such as sunlight and nutrients[1] ▪ Shades out other submerged aquatic plants, leading to weed monocultures ▪ Creates unfavourable conditions for aquatic organisms[2] ▪ Reduces the overall health and biodiversity of the waterbody[2,3]
Economic	▪ Aquatic weed debris block irrigation channels (intakes, pipes & pumps) increasing pumping time and cost[4] ▪ Blocks commercial fishing nets resulting in reduced fish production[4] ▪ Pollutes water used for livestock watering and irrigation[2–4] ▪ Prevents recreational activities like swimming, fishing, boating[4]

Social	▪ Contaminates and taints drinking water supplies[2,3] ▪ Reduces the aesthetic appearance of waterbodies[5] ▪ Causes pungent odours[5] ▪ Thick mats are easily mistaken for firm ground, endangering children and animals ▪ Presents an ideal breeding site for disease carriers like mosquitos and snails[5]

WHAT IS AQ200?

- AQ200 is a broad-spectrum contact aquatic herbicide that is used to control nuisance free-floating aquatic weeds such as azolla, duckweed and salvinia in ponds, lakes, dams, canals, and drainage ditches.[6–9]
- AQ200 is specially designed for use in aquatic environments unlike other commercial herbicides. Its unique formulation ensures that maximum efficacy when killing free-floating aquatic weeds is maintained while having low ecological impacts.[10]
- The active ingredient of AQ200 was first registered for use in aquatic herbicides in 1961, and has consistently been used for free-floating aquatic weed control in commercial and residential settings.[10–12]
- Generally, using aquatic herbicides such as AQ200 rather than the physical removal of aquatic weeds is often faster, less expensive, least labour intensive, and a more thorough management strategy.[7,8]
- When targeting free-floating aquatic weeds AQ200 is mixed 1:250 with town/tank water and shower sprayed directly onto problem free-floating aquatic weeds, after which it trickles down and covers the entire leaves' surfaces.
- When targeting free-floating aquatic weeds the recommended addition of a wetting agent enhances the adhering of AQ200 to weed surfaces, increasing the speed of treatment.[5,13]
- AQ200 has a 10–day withholding period where the water is not used, after which the treated water is safe to use for drinking, livestock watering, irrigation and recreation.

HOW IT WORKS

- AQ200 enters the green plant cells of free-floating aquatic weeds and prevents them from carrying out photosynthesis, essentially starving them of energy.[12,14] Without energy, vital cellular functions of the free-floating aquatic weed cells are impaired, resulting in them shrivelling and dying.[12]
- By using AQ200, the death of free-floating floating aquatic weeds can be achieved in up to 3–14 days.[15]
- AQ200 that doesn't enter the plant cells neutralises when it reaches the soil layer, thus clearing the water of any remaining AQ200.[10] This ensures that AQ200 doesn't accumulate in the environment and is ecologically safe, unlike other herbicides.[16,17]

BENEFITS OF AQ200 OVER OTHER HERBICIDES

- AQ200 is specially formulated to target free-floating aquatic weeds like salvinia, duckweed and azolla, whereas other common herbicides like glyphosate-based herbicides are not approved for application in aquatic environments.[18]
- Glyphosate herbicides are generally not very effective against small, free-floating aquatic weeds like duckweed, salvinia, azolla and wolffia, especially when compared to AQ200 (Table 1).[19]
- AQ200 is ideal for use in both standing and moving water, whereas glyphosate herbicides are less effective in moving water due to rapid dissipation.[20]
- If rainfall occurs within 6 hours of application with glyphosate herbicides, the effectiveness will be greatly reduced. Similarly, glyphosate is not effective on free-floating weeds if they are submerged during application.[20,21] These issues do not arise during AQ200 treatment.
- Compared to other treatment options like Orange oil and glyphosate herbicides, AQ200 is the only herbicide that is equally effective across all growth stages of floating aquatic weeds (Table 2).[21] AQ200 is highly effective during the multilayered growth stage of free-floating aquatic weeds where crowded mats are formed (Table 2). This is significant because it is the only viable treatment method apart from large-scale mechanical removal where the dense layers of floating aquatic weeds can be dealt with.[21]
- AQ200 does not act on the roots of plants[12] meaning that terrestrial plants are safe from the action of any AQ200 dissolved in the water. Other herbicides like glyphosate are less specialised and target the entire plant structure, affecting both aquatic weeds and terrestrial plants alike.[18,22]
- Spraying AQ200 directly on free-floating weeds prevents any AQ200 from reaching banks and killing terrestrial plants. However, with glyphosate herbicides any overspray more than 0.5km into open water often finds its way back to banks and enters terrestrial plants through their roots, and is therefore not recommended.[20]
- Weed resistance to certain herbicides is significantly increasing due to the build-up of common terrestrial herbicides like glyphosate across various environments, including aquatic environments.[23,24] This means that aquatic weeds require larger dosages of these herbicides in order to be killed. AQ200 is intended for use only in aquatic environments, and due to the overall low AQ200 levels reported across other environments, aquatic weed resistance to AQ200 is not likely to occur.[25]
- Studies suggest that the active ingredient of AQ200 poses negligible effects on non-target aquatic organisms like fish, birds, invertebrates and amphibians,[26,27] whereas the active ingredients of other herbicides like glyphosate are classified as slightly to moderately toxic to aquatic organisms.[28]

Table 1: Comparison of the treatment efficacy of AQ200 and glyphosate-based herbicides.[19,29]

Aquatic group and vegetation	AQ200	Glyphosate	Coptrol
Algae			
planktonic	Poor	Poor	Excellent
filamentous	Good	Poor	Excellent
Chara/Nitella	Poor	Poor	Excellent
Floating aquatic plants			
duckweeds	Good	Poor	No Effect
salvinia	Good	Good	No Effect
water hyacinth	Excellent	Good	No Effect
wolffia	Fair	No effect	No Effect
Azolla:			
red azolla	Excellent	Fair	No Effect
green azolla	Excellent	Fair	No Effect

Table 2: Comparison of the treatment efficacy of various herbicides across different Salvinia growth stages.[21]

Herbicide	Primary stage[a]	Secondary stage[b]	Tertiary stage[c]	Multi-layered[d]
Orange oil	✓	✓	×	×
AQ200	✓	✓	✓	✓
Glyphosate	✓	✓	✓	×
Immerse	✓	✓	×	×

[a] Primary: early stages of infestation, crowded plants, water surface visible
[b] Secondary: moderate infestation, water surface barely visible
[c] Tertiary: mature infestation, water surface is not visible
[d] Multilayered: display ridge-like thickening as layers build up

ECOLOGICAL SAFETY OF AQ200

- Low ecological risk of AQ200 due to it having a very short exposure time,[25] and due to strong binding with soil making it unavailable for plant uptake.[10] This makes it less likely for AQ200 to bioconcentrate and bioaccumulate in treatment sites.[16,17]
- The fate of AQ200 in aquatic systems is rapid, with AQ200 having no presence in treated water after 168 hours.[6,9]
- When using AQ200 as indicated, water treated with AQ200 is safe to use for irrigation of commercial and ornamental plants after 10 days of treatment, with visible results in up to 3–14 days.[30,31]
- Residual concentrations of AQ200 in treated water after 96 hours is far below the WHO guideline value for the active ingredient of AQ200 in potable water, meaning the treated water is completely safe to use as drinking water intended for both humans and livestock.[32,33]
- In compliance with Australian Government regulations, the label registration of AQ200 states a prudent withholding period of 10 days after treatment.

FAVOURABLE CONDITIONS FOR AQ200

- The addition of a recommended wetting agent to AQ200 speeds up its herbicidal effect[5] as it improves the adhesion of AQ200 to the floating weeds' surfaces.[13]
- It is best to treat free-floating aquatic weeds early in the growing season when the plant is rapidly growing.[29]

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