UNIVERSITI TEKNOLOGI MARA

EVALUATION ON ECO-BIOLOGY AND TANK-MIX EFFICACY OF OXYFLUORFEN FOR INHIBITION OF SUSCEPTIBLE AND RESISTANT GOOSEGRASS (*Eleusine indica*) BIOTYPES ACROSS FOUR HERBICIDE GROUPS

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ABSTRACT

A heavy infestation of *Eleusine indica* (goosegrass) threatens vegetable crops. Selective herbicides is the primary control method. However, overreliance on herbicides can lead to multiple herbicide resistance in goosegrass. This study aimed to: (1) identify resistance in goosegrass biotypes to clethodim, quizalofop, glyphosate, and an MSMA plus diuron premix; (2) assess environmental effects on germination and emergence in resistant (R) and susceptible (S) biotypes; and (3) determine optimal herbicide mixtures for control. Field trials and rain shelter experiment confirmed resistance in the R biotype, with resistance levels 15-, 12-, 80-, and 2-fold higher than the S biotype for glyphosate, clethodim, quizalofop, and MSMA plus diuron, respectively, based on dose causing 50% shoot biomass reduction. However, glufosinate, oxyfluorfen, and napropamide provided 100% control. The S biotype germinated more quickly across osmotic potentials (-0 to -0.8 MPa) under alternating temperatures (30/20°C, 35/25°C, 35/20°C), while the R biotype exhibited delayed germination, varying with temperature. The S biotype was more tolerant to osmotic stress. When planted at 0–2 cm, the S biotype had higher emergence in sandy loam, sandy clay loam, and loamy sand soils, while the R biotype showed delayed emergence, influenced by soil texture. Neither biotype emerged from a burial depth of 7 cm. The strongest synergistic effect occurred at a 20:80 oxyfluorfen and glufosinate ratio for the S biotype and a 60:40 ratio for the R biotype applied early post emergence at the 3- to 4-leaf stage. At the 0- to 1-leaf stage, the most effective pre-emergence ratio was 60:40 for both biotypes using napropamide plus oxyfluorfen. These findings highlight fitness penalties associated with resistance, including increased seed dormancy and delayed germination/emergence in the R biotype, complicating management. Integrated strategies should exploit these trade-offs by using inversion tillage to bury seeds deeper than 7 cm. Alternatively, light irrigation or shallow tillage (<7 cm) during fallow periods can stimulate emergence of both biotypes, followed by mechanical or chemical control through post-emergence treatment with glufosinate plus oxyfluorfen and pre-emergence application of napropamide plus oxyfluorfen at optimal ratios.

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CHAPTER 1
INTRODUCTION

Goosegrass (*Eleusine indica* (L.) Gaertn) is a monocot weed from the Poaceae family, recognized as a significant C4 grassy weed that reproduces solely through seeds and is characterized by its rapid growth and tiller development (Takano et al., 2016). It is widely distributed across tropical and subtropical regions, particularly in Asia (Ma et al., 2019). As an annual grassy weed, goosegrass primarily propagates through seed propagation. Individual plants have been observed to produce up to 135,000 seeds (Holm et al., 1977), with an average seed count potentially reaching 40,000 per plant. Weed eco-biology encompasses various plant characteristics, including morphology, seed dormancy, germination, growth physiology, competitive capacity, and reproductive biology (Schwartz-Lazaro et al., 2021; Kerr et al., 2019). Goosegrass has been shown to germinate under a wide range of temperatures and moisture stress conditions (Shekoofa et al., 2020). Meanwhile, older goosegrass seeds may not exhibit deep dormancy; however, germination can be enhanced by alternating temperatures, such as under higher temperatures 35/25°C (Hooda et al., 2023). Likely due to the lack of prolonged dormancy, viable goosegrass seeds typically persist in the upper soil for only 2-5 years (Luchian et al., 2019). Goosegrass germination primarily occurs within the top 2, 5 cm of soil, with seedlings rarely emerging from depths greater than 8 cm (Hooda et al., 2023; Ma et al., 2019).

In Malaysia, vegetable crops are extensively cultivated to meet local consumer demands. Smallholder farmers across Malaysia have significantly intensified vegetable production. Goosegrass poses a substantial threat as a noxious weed in vegetable farms, often becoming one of the predominant weed species and leading to considerable losses ranging from 20-70% (Mennan et al., 2020). In vegetable farms, goosegrass is one of weed species of the Poaceae family present in higher numbers (Majrashi et al., 2022). Goosegrass is particularly problematic in annual row-crops such as vegetable crops, where they can establish rapidly before sufficient shading from the crop occurs. For example, significant yield losses, including a 40–80% loss of onion (*Allium cepa*) bulb depending on the intensity and duration of weed competition (Ramalingam et al., 2013),