Barley Grass

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Barley grass (Hordeum murinum L. spp. glaucum and Hordeum murinum L. subsp. leporinum) typically invades southern Australian cropland, pastures, and disturbed sites, especially on high-phosphorus and -nitrogen soils and competes successfully against common pasture legumes, such as lucerne, reducing the productive life of these pastures and of subsequent grain crops.

Keywords: barley grass ; herbicide ; defoliation ; IWM ; lucerne

1. Introduction

Historically, lucerne (Medicago sativa) is the most widely grown perennial pasture legume in southern Australia [1], supplying a livestock feed source [2][3], facilitating the high growth rates and carcass weights desired by prime lamb markets [4], and often the only quality forage available in dry seasons.

Reduced fertiliser use [5][6][7], the prevalence of soil acidity [8], continuous grazing, and drought conditions over time led to a decline in legume productivity across southern Australia [1][9]. Thus, a cascading effect on pasture and soil fertility ensued, creating canopy gaps within pasture stands [10] that are exploited by annual grass weed species [11], which are often introduced from other sites via attachment of seeds to the fleece of grazing sheep. The propagules and seeds produced by some grasses are also problematic to livestock producers, due to their lodgement within animal tissue. Lodged seeds cause significant carcass damage and further welfare, production, and economic impacts at the farm and processing level [12]. Given the recent upward trend in Australian sheep meat prices [13], carcass damage due to grass seed penetration continues to pose significant challenges to the profitability of the Australian sheep industry.

Volunteer barley grass (Hordeum murinum L. spp. glaucum and Hordeum murinum L. subsp. leporinum) typically invades southern Australian cropland, pastures, and disturbed sites, especially on high-phosphorus [14][15] and -nitrogen [16] soils and competes successfully against common pasture legumes, such as lucerne [17], reducing the productive life of these pastures and of subsequent grain crops. Currently, barley grass is an important weed in Australian cropping regions, invading over 244,000 ha and incurring an annual Australian dollars (AUD) $1.7 million loss in grain crop revenue [18]. Its increased prevalence across southern Australia is attributed to climate variability [19][20], herbicide resistance [21][22], and variable seed dormancy patterns, which facilitate the escape of individual plants following herbicide treatment, allowing establishment in crop [23]. The recent appearance of biotypes exhibiting sporadic and/or later emergence results in greater reliance on post-emergent herbicide applications for management [24].

In legume crops and pastures, selective pre-emergent herbicides such as propyzamide (inhibitor of microtubule formation) [25], photosystem II (PS II) inhibitors [26], and post-emergent ACCase inhibitors (“fops” and “dims”) are commonly effective against grass weeds [1][27], as are the non-selective bypiridyl photosystem I inhibitors (paraquat and diquat) and the acetolactate sythase (ALS)-inhibiting imidazolinones [24][27][28]. Recently, the development of bypiridyl photosystem I and ACCase inhibitor resistance in South Australian barley grass populations led to increased use of imidazolinones for barley grass management [21][24][29]. However, imidazolinone resistance is also emerging in some southern Australian Hordeum murinum L. subsp. Leporinum populations [22][30][31], highlighting the need for additional integrated approaches to weed management to further reduce Hordeum spp. infestations in pastures and seed contamination in sheep.

Defoliation by grazing or mowing is a weed control strategy historically used to control barley grass. The impacts of grazing on its survival are conflicting in the literature with control seemingly dependent on stocking rates [32], time of year [33], and the provision of adequate fencing. In pasture legumes, mowing for hay production as an alternative to grazing was shown to be highly effective [34], particularly when defoliation coincides with the onset of the reproductive phase of the target species, thereby reducing seed rain and altering botanical composition [35]. Defoliating plants at boot stage [36] resulted in decreased barley grass fecundity [37] and seed size [34] and subsequently reduced viability post-flowering [38]. The growth and survival of plants under defoliation is also dependent on the frequency and intensity of defoliation, plant size, and stress due to intra- and inter-species competition. This suggests that the impacts of defoliation may be exacerbated at high density given reduced resource allocation for reproduction [39] and limited carbohydrate reserves for regrowth [40][41]. Although previous modelling suggested that weed density influenced efficacy of control in other annual grasses [42], the impact of these interactions in barley grass is unknown.

The integration of defoliation by grazing with additional herbicide application, termed "spray-grazing", is a common method used for the control of broadleaf weeds in Australia [43], but is yet to be investigated for barley grass. Furthermore, the efficacy of integrating defoliation by mowing with herbicide application for effective barley grass management is currently unknown.

This research therefore investigated the interaction between herbicide application and defoliation by mowing, performed at specific barley grass phenological stages, on barley grass survival and reproduction and examined the impact of these treatments on dryland legume pasture production in southern New South Wales (NSW). Further investigative field studies were performed to compare the efficacy of a range of pre- and post-emergent herbicides for barley grass control within the same pasture, while greenhouse studies assessed the effects of defoliation frequency and timing on barley grass survival and seed production when placed under various levels of intraspecific competition.

2. Conclusion

This entry demonstrated that herbicide application and repeated defoliations are effective in legume pastures for reducing barley grass fecundity and seedbank deposition over time, resulting in improved control. However, under southern Australian conditions and an increasingly dry climate, integrated approaches for barley grass management will likely become increasingly important. The results from this study indicate that the combination of herbicide application and defoliations shows significant promise as an integrated weed management (IWM) strategy against barley grass, provided applications are timed accurately. Currently, modelling is underway to examine the long-term effect of defoliation and herbicides on both barley grass survival and fecundity, in order to better predict the utility of a systems-based approach for management under variable Australian conditions.

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