ABSTRACT

Studies were conducted to investigate aspects of the biology and control of Torpedograss (Panicum repens L.), a perennial, rhizomatous grass weed, native to the Old World tropics, which includes Sri Lanka as part of the Indo_Malayan region. This weed has been found to cause many problems in Sri Lanka and in other tropical climates, in a diversity of habitats, ranging from upland, terrestrial habitats to aquatic or semi-aquatic habitats. Studies on its biology revealed that the grass depends almost entirely on vegetative reproduction with its rhizome system, for propagation and perennation.

No major differences in the pattern of growth were found in plants grown at different planting dates, except that the plants of the January and June plantings made greater total growth, compared with plantings made in February, March and April. The observed differences could be explained by the adequate moisture that was available to the January and June plantings coinciding with monsoonal rains, whereas the other plantings appeared to have suffered from the intense drought periods which prevailed inbetween the monsoons.

Despite the differences in the total growth made by the plants of different planting dates, each allocated nearly equal resources to shoot (35-40% of total plant weight) and rhizome production (34-38% of total plant weight) after 20-weeks of growth. Following the withering of the mother culm in approximately 10-weeks, the shoot system of each plant comprised of 3-4 dominant primary tillers, and a large number of smaller tillers formed from upturned rhizome apices and lateral buds on rhizomes. After 20-weeks of growth, the average length of rhizomes produced was 76.2 cm across all planting dates, and the mean rhizome dry weight 6.0 g/plant.

Production of tillers and rhizomes was strongly and adversely affected by an increase in plant density stress. However, a shift in the pattern of dry matter partitioning did not occur as a result of increasing competitive stress. With or without competition from its own population, torpedograss plants allocated 23-29% of their dry weight to rhizome production, reflecting the significance of vegetative means of propagation for the plant.

The effect of the highly systemic non-selective herbicide, Glyphosate ('Round Up') applied as a foliar spray, on the shoot growth, regrowth from 'crown' and rhizome bud-viability of the weed was studied. In general, rates of 1.0 to 4.0 kg a.i/ha killed 80-100% of aerial shoots and suppressed 90-100% of regrowth from treated plants. Rates above 1.0 kg/ha also killed 80-97% of rhizome buds within 7 days of spraying. Rates below 1.0 kg/ha gave insufficient regrowth suppression and bud-kill, and were inadequate to control well-established mature plants. Plant age was a factor which affected glyphosate performance. While the young plants under 8-weeks of age were effectively killed by lower rates, the killing of older plants up to 20-weeks of age required rates above 1.0 kg/ha. Rhizome length was not a significant factor influencing the killing of rhizome buds by a range of rates from 0.5 to 4.0 kg/ha. However, the results of several experiments indicated that a rate close to 4.0 kg/ha was needed for a 100% kill of all buds in well-developed rhizome systems. Superior control of the weed was obtained by split-applications of of glyphosate within the range of 0.5 and 2.0 kg a.i/ha, compared to one full-rate treatment. A split-application of a

total dose of 1.5 or 2.0 kg/ha, completely prevented regrowth, and achieved 85 to 95% bud-kill.

The suitability of using Fluazifop-P-butyl, a new generation, selective 'graminicide', well-known for systemic activity and ability to control a wide range of perennial grass weeds, for torpedograss control was also investigated.

Studies also revealed that the incorporation of the non-ionic surfactant 'Agral 90' or oil-additive 'Atplus 411F' into fluazifop-P sprays, significantly improved the efficacy of the herbicide and its ability to control torpedograss. Agral 90 at 0.25% v/v or Atplus at 1.0% v/v significantly improved the regrowth suppression and rhizome bud-kill of torpedograss achieved by Fluazifop at rates of 0.125, 0.25, 0.5 and 1.0 kg a.i/ha. Increasing the surfactant concentration in spray solution up to 1.0% v/v or oil-additive concentration up to 2.0% v/v improved the efficacy of the herbicide further. When torpedograss foliage was washed either 0, 1, 6, 24, 48 or 72 h after treatment, the degree of control achieved was generally not affected by the type of adjuvant, surfactant or oil-additive used. With Fluazifop-P applied alone, at least 96 h was needed to insure adequate basipetal translocation to obtain maximum kill of rhizome buds and regrowth suppression. The surfactant or oil-additive shortened this interval to 48 h (0.25% of surfactant or 1.0% of oil v/v), and to 24 h (1.0% of surfactant or 2.0% of oil, v/v). These studies confirmed that Fluazifop-P with incorporated additives, can efficiently control torpedograss and that this herbicide may be used as an alternative to glyphosate in this task.

In another study the nature of the rhizome carbohydrates of torpedograss was investigated. Paper and thin-layer chromatography, gas-liquid chromatography (GLC), high-pressure liquid chromatography (HPLC) and NMR spectroscopy were used in this study. The combined results of these studies indicated the presence of three soluble carbohydrates, (monosaccharides- glucose, fructose; disaccharide- sucrose) and a fourth carbohydrate which was not readily identified, in the unhydrolyzed extract. However, when the rhizome extract was hydrolysed using 2N sulphuric acid and analysed, the presence of a 6-deoxy sugar was indicated, in addition to glucose, fructose and sucrose. This sugar was identified to be Rhamnose, by GLC and HPLC procedures, suggesting that the fourth carbohydrate in the unhydrolysed extract could be a disaccharide or a oligosaccharide constituting of rhamnose units alone, or rhamnose units linked to glucose or fructose, or both. The amount of total soluble carbohydrates in the rhizomes estimated from HPLC peaks was found to vary from 17% to 35% of the dry weight of rhizomes in normal plants, with the relative contents of glucose, fructose and sucrose respectively being, approximately 24-34%, 26-46% and 27-40% of the total soluble carbohydrates. Treatment of torpedograss with glyphosate and fluazifop-P resulted in a considerable reduction of total soluble carbohydrates in the rhizomes, over 6-8 weeks after treatment.

The overall results of the studies provided an insight into the highly aggressive growth habit of this perennial grass weed, its rhizome growth, rhizome carbohydrate reserves, potential for regrowth and regeneration, and how two herbicides can be effectively used to manage heavy infestations of the weed.