HERBICIDE RESISTANCE IN WILD RADISH (*RAPHANUS RAPHANISTRUM*): NEW SEED SOAKING METHOD FOR RESISTANCE TESTING

A. Hashem[1], S. Hallam[2], D. Bowran[3] and M. Allan[4]

[1]Dryland Research Institute, Agriculture Western Australia, Merredin 6415. [2]Applied Biology student, Nottingham Trent University, UK. [3]Agriculture Western Australia, Northam 6401.
[4]Agriculture Western Australia, South Perth 6151.

Abstract

Herbicide resistance testing of 78 suspected resistant populations of wild radish showed that 50% were resistant to ALS-inhibiting herbicides. Of the resistant populations, 62% came from north and north central agricultural zones and 38% came from central and south central zones. Seed soaking method as alternative method of testing resistance of wild radish to ALS inhibiting herbicides could be three weeks quicker than the traditional method.

Keywords: Wild radish, resistance, ALS inhibiting herbicides, seed soaking method

Widespread and persistent use of ALS-inhibiting herbicides has led to the appearance of weed biotypes resistant to these herbicides in Australia (1,2,3). High efficacy of ALS-inhibiting herbicides selects for resistance by weeds after 4 to 7 applications (4). The traditional method of testing resistance by growing weed plants in glasshouse needs 8 to 10 weeks, limiting the efficiency of testing resistance. An alternative method of testing resistance in weeds is desirable to improve the efficiency of herbicide resistance testing.

Materials and methods

Traditional method of testing resistance

Seeds of 78 suspected resistant wild radish populations were grown in glasshouse in1997. Radish seedlings were sprayed with label rates of ALS-inhibiting herbicides at 2-4 leaf stages. Survivorship of seedlings was recorded 2-3 weeks after spraying.

Seed soaking method

Clean seeds of wild radish population #3 (susceptible) and #7 (resistant) were soaked in metosulam and triasulfuron solutions separately for 24 hours and then sown in sand medium. Emergence was recorded three weeks after seeding. Seedling survivorship was recorded five weeks after seeding. Surviving seedlings were then sprayed with 5 g a.i./ ha of metosulam and 11g a.i. /ha of triasulfuron to confirm resistance in population #7.

Results and discussion

Resistance status in wild radish

Of the wild radish populations tested, 42-50% were susceptible to ALS inhibiting herbicides, 10-12% were at early stages of resistance (ER), and 39-42% were resistant (R). Of the resistant populations, 62% came from north and north central agricultural zones and 38% from south and south central zones. Susceptible populations received 0-6 applications of mainly sulfonylureas, ER 3-6 applications, and R 4-12 applications with up to 4 applications within the same season in certain populations. Although the resistance level observed in these populations to imidazolinones and triazolopyrimidines was similar to sulfonylureas, only few or no applications of them were made in most of these populations. This indicates that cross resistance between sulfonylureas and other ALS-inhibiting herbicides is likely to exist in these

populations as found in a resistant biotype of *Sonchus oleraceus* selected with chlorosulfuron for 10 consecutive years (3).

Seed soaking method

At five weeks after seeding, both metosulam and triasulfuron reduced seedling survivorship in population #3 to near zero at 5-10 ppm while in population #7 many seedlings survived the seed soaking treatments with these herbicides even at 10-20 ppm (Fig. 1). Subsequent foliar spray of metosulam and triasulfuron did not kill the surviving seedlings of population #7 indicating that the seed soaking was effective in differentiating the susceptible and resistant populations. While conventional method took about 8-10 weeks, the seed soaking method took 5-6 weeks for testing resistance in wild radish.

Based on the LD_{50} values, population #7 was, on the average, 12.5-fold resistant than population #3. Similar resistance to ALS-inhibiting herbicides was observed in wild radish (2), *Sonchus oleraceus* (3), *Rapistrum rugusum, Sysimbrium orientale, Sonchus oleraceus, Fallopia convolvulus, and Sysimbrium thellungii* (1). The apparent difference between the response curves of metosulam and triasulfuron in population #7 could probably be due to a difference in the mutated enzymes that conferred the tolerance. Further studies are necessary to determine if the resistance in population #7 is metabolic or target site.

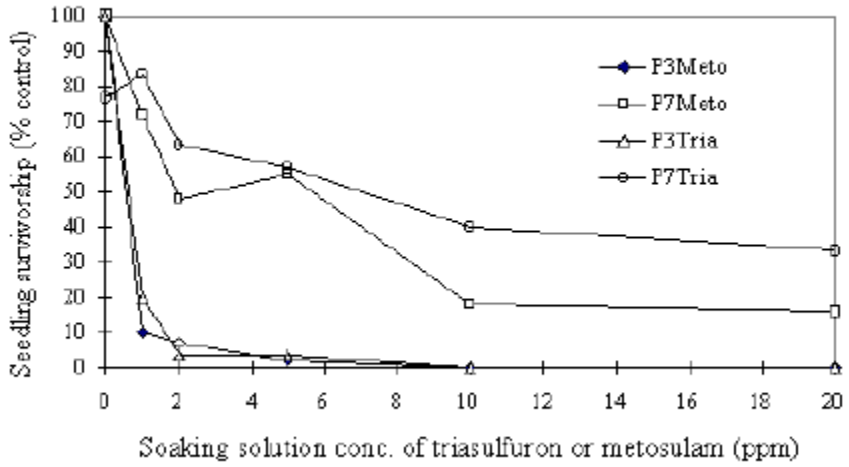

Figure 1: Seedling survival of wild radish populations #3 and #7 at five weeks after seeding. Seeds of each population were soaked in solutions of triasulfuron or metosulam for 24 hours before seeding. P3Meto = seeds of population #3 treated with metosulam, P7Meto = seeds of population #7 treated with metosulam, P3Tria = seeds of population #3 treated with triasulfuron, and P7Tria = seeds of population #7 treated with triasulfuron.

Conclusion

Wild radish has developed resistance to ALS-inhibiting herbicides in the wheatbelt of WA with more frequencies in the northern than southern zones. Seed soaking method shows potential for testing resistance of wild radish to ALS-inhibiting herbicides more quickly than traditional method.

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