Efficacy of several herbicides and mowing against johnsongrass (*Sorghum halepense*)

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INTRODUCTION

Johnsongrass (*S. halepense*) is a perennial weed with a wide ecological amplitude and high competitiveness that infests more than 30 crops across 53 countries (Holm et al., 1991). In general, it is considered to be among the most troublesome and noxious weeds for many annual and perennial crops, while several herbicides show poor control. High fecundity, seed dormancy, residual seedbank life, massive rhizome production, vigorous growth (C4) and considerable variation in morphology contribute to survival, weediness and high competitive ability of johnsongrass (Dweikat, 2005; Vila-Aiub et al., 2007). The first report of glyphosate resistant (GR) johnsongrass was from Argentina in 2005, while later more cases were revealed (Vila-Aiub et al., 2007; Heap, 2020).

Glyphosate is by-far the leading postemergence, systemic, broad-spectrum herbicide for the control of both annual and perennial weeds. However, a number of factors have been implicated on the development of glyphosate resistant weed species worldwide and in particular in Europe. Among the most important contributing factors to such a situation are: 1) the long history and overreliance on glyphosate use; 2) the frequent glyphosate application (more than once a year); 3) limited or no rotation of herbicides with different mode of action; 4) application of glyphosate with wrong water volume, weed growth stage and/or spray pressure; 5) limited use of integrated weed management approaches. All the above resulted in the selection of glyphosate resistance in many weed species in more than 25 countries around the world.

OBJECTIVES

The present study was conducted due to several incidents of failure of glyphosate on *S. halepense* in perennial crops of several Mediterranean countries. The main objectives of this research were to evaluate the efficacy of several herbicides and different rates and the potential role of mowing against johnsongrass under real field conditions.

METHODS & MATERIALS

The field experiment was conducted in a conventional olive orchard in western Greece after complains by the local farmers and agronomists. Treatments were a) untreated (control), b) mowing, c) glyphosate (1440 g a.e./ha), d) glyphosate (2880 g a.e./ha), e) diguat (600 g a.i./ha), f) diquat (900 g a.i./ha), g) glufosinate (600 g a.i./ha) and h) glufosinate (900 g a.i./ha). All applications were conducted at the recommended stage on 12th of June 2019. At 3 weeks after treatment (WAT), visual injury and biomass production were recorded. Moreover, the effects of the combination of mowing with chemical control were also evaluated

Fig. 1. Johnsongrass plants from olive orchards in Greece

RESULTS

1. **Glyphosate and glufosinate at low doses resulted in efficacy ranging between 35 and 45%, while even the higher rates gave efficacy lower than 80% (Fig. 2)**

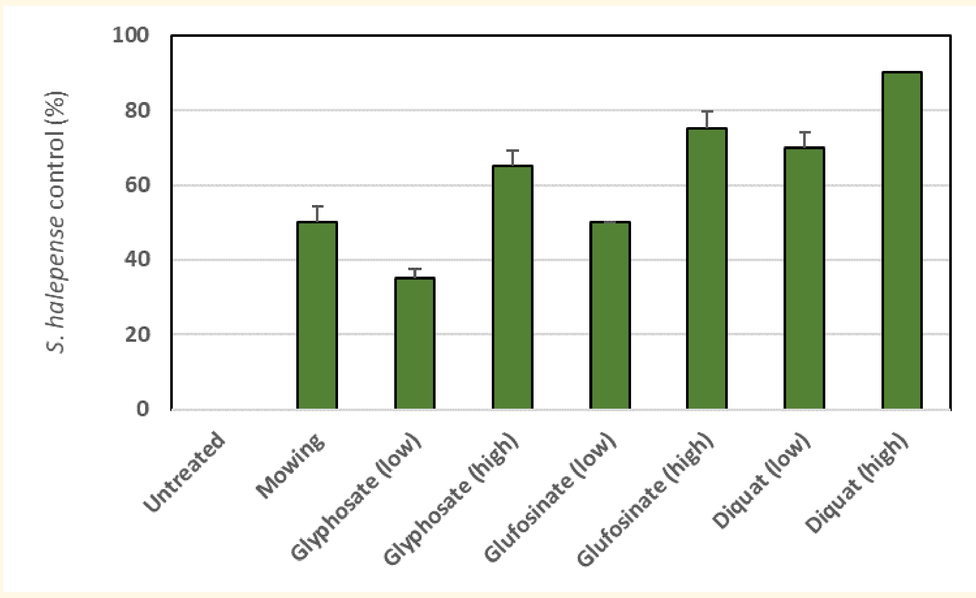

Fig. 2. Efficacy of the several treatments against *S. halepense* at 3 WAT (vertical bars indicate standard errors of the means)

2. **Mowing followed by chemical control proved to be a very effective combination with control equal with or higher than 90% (Table 1)**

Table 1. Johnsongrass biomass response after mowing and mowing followed by several herbicide applications. Different low case letters within the same column denote statistically significant differences (p<0.05)

	***S. halepense* biomass (% of untreated)**	
Treatments	**3 WAT**	**6 WAT**
Mowing	**50 b**	**30 d**
Mowing + glyphosate (2880 g ae/ha)	**95 a**	**85 c**
Mowing + glufosinate (600 g ai/ha)	**90 a**	**75 c**
Mowing + diquat (600 g ai/ha)	**95 a**	**85 c**

DISCUSSION

- Overreliance on glyphosate can greatly increase the risks of reduced efficacy of the herbicide on weeds and weed resistance even in regions without glyphosate-resistant crops.
- Glyphosate resistance was confirmed for the first time for *S. halepense* while efficacy of glufosinate was also not satisfactory.
- Mowing alone or followed by chemical control (glyphosate, glufosinate or diquat) resulted in control equal with or higher than 90%.
- Other herbicides, along with various integrated management strategies (e.g. soil tillage, mowing, cover crops) could be involved, in order to manage or mitigate the spreading of glyphosate resistance in such species.

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