Crop Protection 36 (2012) 65–72

Contents lists available at SciVerse ScienceDirect

Crop Protection

journal homepage: www.elsevier.com/locate/cropro

Weed control in *lampascione* – *Muscari comosum* (L.) Mill

A. Bonasia*, G. Conversa, C. Lazzizera, P. La Rotonda, A. Elia

Department of Agro-Environmental Science, Chemistry and Plant Protection, University of Foggia, via Napoli 25, 71100 Foggia, Italy

ARTICLE INFO

Article history:
Received 6 December 2010
Received in revised form
1 February 2012
Accepted 3 February 2012

Keywords:
Chlorthal-dimethyl
Chlorpropham
Oxyfluorfen
Ioxynil
Pendimethalin
Chloridazon
Flazasulfuron
Oxadiazon

ABSTRACT

Weed management studies in *lampascione* – *Muscari comosum* (L.) Mill – a bulb crop, were carried out in the Apulia Region (southern Italy) in 2007–2008 and 2008–2009, using various pre- and post-emergence herbicides. Herbicide treatments were compared with hand-weeded and unweeded controls. Weed control and crop injury index, yield, morphology and dry matter content of bulbs were recorded. The most dominant weed species were *Veronica hederifolia* L., *Lamium purpureum* L., and *Stellaria media* (L.) Vill. Manual weeding gave the highest yield (11.3 t/ha, on average), that was 31% higher compared to the unweeded control.

During winter and until four months after planting, both pre-emergence herbicides were effective in keeping soil free from weeds, without negative effects on the sprouting or growth of *lampascione* bulbs.

Among the tested post-emergence active ingredients, Oxyfluorfen, Oxadiazon, and Ioxynil-Pendimethalin and Oxyfluorfen + Pendimethalin mixtures showed a low selectivity toward the crop. Despite a good weed control with a low level of crop injury, Ionyxil produced also negative effects on bulb dry matter. Pendimethalin and Chloridazon were variable in their effect and they did not provide clear results either in terms of phyto-toxicity or weed control, therefore they should be further investigated. Flazasulfuron always resulted in very low crop injury (14%, on average) and adequate weed control (56%, on average), while maintaining a 14% higher mean yield compared to the unweeded control and similar to the weed-free control.

Since the *lampascione* crop has a long cycle from winter to early summer, we suggest that a combination of a pre-emergence herbicide (Chlorthal-dimethyl or Chlorpropham) in winter, followed by a post-emergence Flazasulfuron application at 100 g a.i./ha in early spring, should allow the best weed control without any negative effects on bulb yield.

1. Introduction

Muscari comosum (L.) Mill, formerly classified in the Liliaceae Family, has been recently included in the Hyacinthaceae Family, according to (APG, 2003).

It is a wild species that grows in a hot and arid climate in Southern Europe, Northern Africa and Western Asia (Bianco et al., 2009).

It is a herbaceous perennial plant thanks to the formation of a globose to ovate bulb with reddish to pinkish outer tunics (skin-like coverings protecting the fleshy scales).

In Southern Europe, seed germination occurs in November/December, with optimum temperature near 10 °C (Doussi and Thanos, 2002). After the first season of vegetative growth, a small bulb (below 1 cm in diameter) is produced as the foliage senesces in summer. Three to four true leaves (20–60 cm long) are produced from this bulb in the following year during the fall-winter-spring period, allowing a progressive enlargement of the bulb and the appearance of a floral stalk in the third year (after juvenile phase). In summer, the aerial part (leaves and flower stalks) senesces (Maiellaro and Macchia, 2001). In nature the annual cycle is repeated for several years while the bulb grows up to 3–4 cm in diameter.

During the first two years after germination, the species is characterized by the presence of retractile roots which result in the progressive deepening of the bulbs up to 25–30 cm in the soil, (Herrmann et al., 2006).

A *lampascione* crop can be established from seeds, bulbs, and bulbils (small secondary bulbs, produced laterally to the main bulb, also called offsets). By starting from 2 year-old bulbs, the marketable size of bulbs (>2.5 cm) will be reached after 1–2 years of cultivation. However, if the crop is started from seeds, bulbs are marketed after three to five years.

M. comosum is used in the traditional gastronomy of Southern Italy. In Apulia, Basilicata, Campania, Molise and Calabria regions it

* Corresponding author. Tel.: +39 881589237; fax: +39 881589342.
E-mail address: a.bonasia@unifg.it (A. Bonasia).

0261-2194/$ – see front matter © 2012 Elsevier Ltd. All rights reserved.
doi:10.1016/j.cropro.2012.02.001

is commonly named "*lampascione*" (other local names are: "*lambagione*", "*lampagione*", "*muscaro*", "*cipuddine*" and "*pampasciuli*", depending on dialects). The edible part is a bitter bulb, consumed cooked, and the blue-violet flowers, consumed in salad. The food use of the bulbs has a long history that can be traced back to the Egyptians, Greeks and other Mediterranean peoples (Casoria et al., 1999).

Lampascione bulbs have diuretic, anti-inflammatory, antioxidant and anti-cancer properties, associated to the homo-flavonoids, homo-isoflavonoids and complex of glycoside isolated from bulbs (Adinolfi et al., 1983; Pieroni et al., 2002), corresponding to its bitter taste (Borgonovo et al., 2008).

In the past *lampascione* bulbs were harvested from the wild. Today the expansion of agriculture has consistently reduced the Italian supply of bulbs and most of the bulbs on the market are imported from wild harvesting in Northern Africa, mainly in Morocco and Tunisia. Although the species has been occasionally cultivated in the South of Italy, there is now an increasing interest in its production due to the high value of the bulbs and the diminishing quantity imported from Northern Africa. The species can be grown in light soils, suitable for the cultivation of root vegetables. The commercial product (bulbs 2.5–5 cm in diameter) is obtained within 3–5 years starting from seeds. In order to establish *lampascione* as a profitable new-crop, it has been suggested that the plantlets can be grown for the first two years from seed planted at a high density in shallow containers. In this period one of the main agronomic problems is weed control. Because *M. comosum* is a weak competitor, due to its low stature and small leaf area, reliable and cost-effective weed control strategies must be developed. According to the growers experiences on this crop, weed control is one of the major problems in *lampascione* growing, being a key factor for improving marketable bulb yield and thus profitability of the crop.

No studies have been carried out on the effect of weeds or their control in this crop. Consequently no herbicide is currently labeled for *lampascione*. The main objective of this study was to evaluate the effect of several active ingredients on weed control, crop toxicity, bulb quality and yield.

2. Materials and methods

2.1. Experimental site and procedures

Two field experiments were carried out in 2007–2008 (exp. 1) and 2008–2009 (exp. 2) on a commercial farm located in Zapponeta, Adriatic Sea Coast, East of Foggia Province, Apulia Region (latitude 41° 27′ N, longitude 15° 57′ E, 2 m above mean sea level).

The soil is sandy (93% sand, 1.0% silt and 6% clay), pH 8.3, with 1.9% organic matter, total N, available P, and exchangeable K content of, 0.4, 33 and 274 mg/kg, respectively. The experimental site is normally heavily infested by different weed species during *lampascione* growing time. Two-year-old bulbs, 1.5 ± 0.5 cm diameter, were hand transplanted on 01/11/07 (exp. 1) and 12/12/08 (exp. 2), using a density of 100 ± 5 bulbs per square meter. The bulbs were planted 5 cm deep, and spaced 1–2 cm apart in rows in 30-cm spaced rows, in an experimental plot unit of 10 m^2 (2 m wide and 5 m long), separated by a 1 m buffer area. The soil was fertilized before planting with 10 and 50 kg/ha of P and K respectively; nitrogen fertilizer (50 kg/ha) was applied to the soil surface in bands next to the rows, at the end of February. The crop was sprinkler irrigated twice during the driest period (April–May). *Lampascione* bulbs were harvested at complete drying of leaves on June 17th 2008 (exp. 1–230 days after planting – DAP) and June 22nd 2009 (exp. 2–195 DAP), by hand-hoe from a random 1 m^2 of each plot.

The different phases from planting to harvest of *lampascione* crops were monitored and the most important are illustrated in Fig. 1. This also includes the period of maximum weed presence during crop growth and the dates of the chemical treatments in the two trials.

Treatments included (Table 1):

1st experiment: (a) two pre-emergence herbicides (PRE); (b) eight post-emergence herbicides (POST) all applied on 12/03/2008 – 133 DAP.

2nd experiment: (a) two PRE as in the first experiment; (b) four POST chosen on the basis of herbicide toxicity of previous exp. 1, applied on 13/03/2009 – 92 DAP; (c) two application doses of three POST, applied on 13/03/2009 – 92 DAP; (d) two application methods of two POST, applied at the highest dose: as single application (on 13/03/2009 – 92 DAP) *vs* split application with a 15 day interval respectively, on 13/03/2009 – 92 DAP and on 28/03/2009 – 107 DAP.

Two control plots were included in both experiments: weed-infested control (plot kept unweeded until harvest); weed-free control (plot kept weeded until harvest by manual hoeing). In the weed-free plot, the weeds were removed three times during the growing crop cycle: on 12/03/08 (133 DAP), 9/04/08 (161 DAP) and 10/05/09 (192 DAP) during exp. 1, and on 13/03/2009 (94 DAP), 17/4/09 (129DAP) and 19/05/2009 (161 DAP) during exp. 2.

The experiments were arranged in completely randomized block design with four replications.

PRE were directly applied to the soil surface 7 days after *lampascione* planting. The rainfall in the 10 days after PRE treatments was 103.2 (exp. 1) and 46.0 mm (exp. 2). POST application started after weed emergence (5 cm in height), when *lampascione* plants were at the 3rd leaf (pre-flowering) (Fig. 1). Herbicides were applied by compressed air backpack sprayer, equipped with a 5 nozzle boom (SHR-4100, Echo, Tokyo, Japan), mounted on a 2 m long pole, at a spray water volume of 500 L/ha.

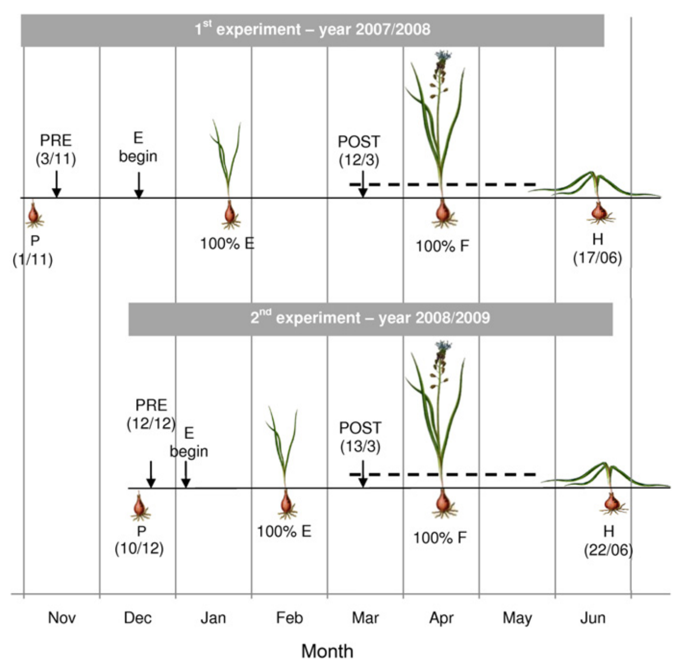

Fig. 1. Most important phases (P = Planting; E = emergence, F = flowering, H = harvest) application of the chemical treatments (PRE = pre-emergence and POST = post-emergence treatments) and period of maximum weeds presence (dashed line) during the two *lampascione* trials. When reported, the exact dates (day/month) are indicated in brackets.