Indian Journal of Agricultural Sciences **84** (12): 1546–9, December 2014/Article

Evaluation of pre-emergence herbicides in gladiolus (*Gladiolus*)

GANESH B KADAM[1], GUNJEET KUMAR[2], TARAKNATHSAHA[3], RAKESH KUMAR[4], AJAI KUMAR TIWARI[5] and RAMESH KUMAR[6]

Directorate of Floricultural Research, Pusa Campus, New Delhi 110 012

Received: 7 August 2013; Revised accepted: 4 July 2014

ABSTRACT

An experiment was carried out to evaluate the effect of different herbicides on weed control and growth and development of gladiolus (*Gladiolus* (Tourn) L.) cv. White Prosperity grown at research farm of Directorate of Floricultural Research, New Delhi during 2011-12 and 2012-13 seasons. The major weeds infesting the experimental field were *Ageratum conyzoides, Chenopodium album, Convolvulus arvensis*, *Cynodon dactylon, Cyprus rotundas, Digera arvensis, Digitaria adscendance*, *Euphobia hirta, Parthenium hysterophorus* and *Portulaca.* The unweeded control plots recorded maximum weeds at 25 (153.2 m^2) and 50 (180.7/m^2) days after planting (DAP). Whereas significantly low weed count, fresh weight and dry weight were recorded in the pre-emergence application of Atrazine (@ 1.0 and 1.5 kg a.i./ha. The maximum weed control efficiency (WCE) was recorded in Atrazine (@ 1.5 kg a.i./ha (82.2)). However, pre-emergence application of Pendimethalin (1.0 and 0.75 kg a.i./ha) had superior effect on the plant height, spike length, rachis length and number of florets. The number of corms/plant, fresh weight of corms and diameter of corms were maximum with application of Atrazine (@ 1.0 and 1.5 kg a.i./ha) however, number of cormels were found maximum (28.6) in Pendimethalin @ 1.0 kg a.i./ha and lowest (2.4) in Atrazine @ 1.0 kg a.i./ha.

Key words: Gladiolus, Herbicides, Pre-emergence, Weed control efficiency

Gladiolus is a popular cut flower in national and international trade. Its magnificent inflorescence with array of colours makes it suitable for herbaceous borders, beddings, pots and as cut flower. The remarkable beauty of spikes with varied colours and hues attracts a large number of flower lovers. Commercially it is grown for cut flower or planting stock (corms/cormels) production. For quality spike production, it is grown in congenial environment that favours weed's growth. The weeds not only compete vertically and horizontally for space but also consume the vital nutrients and the much-needed water. Fast growing weeds may even block the sunlight for the small sprouting corms and cormels. Uncontrolled growth of weeds may lead to poor spike quality and increases difficulty in harvesting of corms and cormels. Unlike horticulturally developed countries, we use manual weeding techniques which are time consuming and costly. As crop growing season coincides with that of major crops like wheat, gram and mustard in North India, the availability of efficient labour at reasonable rates becomes difficult. Many weeds act as host and serves as reservoir of viruses such as Bean yellow mosaic potyvirus (ByMV), Cucumber mosaic cucumovirus (CMV) to the next season crop (Dufus 1971, Sidek *et al*. 1999). Though herbicides check the growth of weeds, many of these have phytotoxic effects on the leaves and affect the growth of the plant and spike quality. Hence, this investigation was carried out to select the suitable herbicide(s), effective in controlling the weeds without any adverse effect on the plants.

[1]Scientist (e mail: ganeshiari@gmail.com), [2]Scientist Senior Scale (e mail: kumar_gunjeet@yahoo.com), [3]Scientist (e mail: tnsaha@gmail.com), [4]Assistant Professor, MKRUA&T, Banda (e mail: rakesh_kashav@yahoo.co.in), [5]Senior Scientist (e mail: drajaitiwari@gmail.com), [6]Director (DFR) (e mail: directordfr@gmail.com)

MATERIALS AND METHODS

The investigation was carried out under open field conditions at the research farm of Directorate of Floricultural Research, Pusa Campus, New Delhi during 2011-12 and 2012-13. The experimental site is located at an altitude of about 228.6 m above mean sea level and has Latitude of 28°38'23"N and Longitude of 77°9'27"E. The experimental field was ploughed twice and well decomposed Farm Yard Manure (FYM) was applied evenly at a rate of 50 MT/ha, and mixed thoroughly in the soil. Cold stored corms of cultivar White Prosperity were treated with Bavistin (0.2%) before 24 hours of planting. Uniform size corms (4.0–4.5cm) were planted in beds (2.0 × 2.0 m) at a spacing of 30 × 20 cm at 8 cm depth in the last week of October. The experiment was conducted in RBD and replicated thrice. Ten treatments including control–weedfree (weekly hand weeding), control–unweeded, Atrazine–1.0 and 1.5 kg a.i./ha, Metribuzin–0.25 and 0.50 kg a.i./ha, Butachlor–1.0 and 1.5 kg a.i./ha, Pendimethalin–0.75 and 1.0 kg a.i./ha were applied. The required quantity of herbicides was dissolved

in water (@ 750 l/ha) and applied by Knapsack sprayer on the nextday after planting. All treated plots were kept unweeded except in control (weed free) plot, where weekly manual weeding was carried out. The weeds were counted on 25 and 50 days after planting (DAP). For counting of weeds, a quadrate (50 × 50 cm) measuring 0.25 m^2 was placed randomly at two sites per plot and weeds growing within this quadrate were counted and then computed for one square meter area. For dry weight, weed samples were dried in an oven at 60°C for 48 hours and then weighed. The final data was expressed as gram per square meter (g/m^2). Weed control efficiency (WCE) was calculated with following formula.

$$WCE = \frac{DW^1 - DW}{DW^1}$$

(Where DW^1 is dry weight of weeds in unweeded control and DW is weed dry weight of treatments.)

The observations were recorded on five randomly selected plants on parameters, viz. days to first floret opening, spike length (cm), rachis length (cm), diameter of second floret (mm), number of florets/spike, number of florets open at a time, number of leaves/plant, number of corms/plant, diameter of corm (mm), fresh weight of corm (g), number of cormels/plant and fresh weight of cormels/plant (g). The data was pooled and analyzed using ANOVA, and the critical difference (CD) values at 5% level ofsignificance were computed as described by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Effect on weed population

In the present study, species such as *Ageratum conyzoides, Chenopodium album, Convolvulus arvensis*, *Cynodon dactylon, Cyprus rotundas, Digera arvensis, Digitaria adscendance*, *Euphobia hirta, Parthenium hysterophorus* and *Portulaca* sp. were observed in the experiential field of which *Chenopodium album* and *Cyprus rotundas* were the major weeds. All the weed control treatments proved effective in reducing the weed population as compared with unweeded control (Table 1). The unweeded control plots produced maximum weeds at 25 (153.2/m^2) and 50 (180.7/m^2) DAP. Atrazine @1.5 kg a.i./ha resulted in significantly lower weed population at 25 (11.8/m^2) and at 50 (29.5/m^2) DAP as compared to other treatments. Weed free plot also had higher weed population because weekly manual weeding allowed more light, space and nutrients for remaining buried weed seeds to germinate and there by resulting in increased weeds number. Unweeded control plots recorded significantly maximum fresh (32.4 g/m^2) and dry weight (10.5 g/m^2) of weeds followed by Butachlor @ 1.5 kg (19.6 and 6.0 g/m^2respectively) at 25 DAP and similar trend was noticed at 50 DAP. The highest fresh and dry weight recorded in unweeded control plot was because of the prolonged growth period available to weeds in the field. In comparison weekly weeding in weed free control plots showed the benefits of weeding at earlier stages of growth.

Atrazine @ 1.5 kg a.i./ha recorded maximum weed control efficiency (82.2 and 69.8), minimum fresh weight of weeds (5.2 and 9.7 g/m^2) and dry weight of weeds (1.9 and 3.0 g/m^2) at 25 and 50 DAP respectively as compared to other treatments. However, lowest WCE (42.5) was found in Pendimethalin @ 0.75 kg a.i./ha followed by Butachlor @1.5 kg a.i./ha (43.2). From the results it is clear that application of atrazine @ 1.5 kg a.i./ha was found effective in controlling weeds in gladiolus. These results are in line with that of Yadav and Bose (1987) and Chahal *et al.* (1994). The variability in weed population in different treatments could be attributed to the fact that some herbicidal treatments were more effective in weed control than others.

Effect on plant growth

The data presented in Table 2 showed that significantly short plant height was recorded in unweeded control (76.7 cm), whereas tallest plant height was found in Pendimethalin 1.0 kg a.i./ha (112.9 cm) followed by weed free control (111.5 cm). The decrease in plant height in unweeded control could be the adverse effect of weeds on growth of gladiolus. The results show (Table 2) that Pendimethalin @ 1.0 kg a.i./ha recorded significantly superior spike length (98.3

Table 1 Effect of herbicides on weed population, fresh and dry weight of weeds in gladiolus var. White Prosperity

Treatment	Weed count/m^2	FW of weeds (g)	DW of weeds (g)	WCE	Weed count/m^2	FW of weeds (g)	DW of weeds (g)	WCE
	25 DAP				50 DAP			
Atrazin-1.0 kg a.i./ha	21.2	13.6	4.2	60.3	47.2	17.0	4.7	52.1
Atrazin-1.5 kg a.i./ha	11.8	5.2	1.9	82.2	29.5	9.7	3.0	69.8
Metribuzin-0.25 kg a.i./ha	33.8	13.3	3.7	64.5	37.3	12.0	3.5	64.3
Metribuzin-0.50 kg a.i./ha	25.5	14.8	4.7	55.0	33.2	11.5	3.7	62.5
Butachlor-1.0 kg a.i./ha	43.3	14.8	3.8	63.5	41.8	14.0	4.2	57.2
Butachlor-1.5 kg a.i./ha	38.5	19.6	6.0	43.2	40.2	16.2	4.8	51.8
Pendimethalin-0.75 kg a.i./ha	28.8	18.9	6.0	42.5	41.0	15.3	4.9	50.6
Pendimethalin-1.0 kg a.i./ha	25.7	13.8	4.9	53.1	31.0	13.2	3.6	63.2
Control (unweeded)	153.2	32.4	10.5		180.7	33.3	9.9	
Control (weed free)	19.7	7.8	2.4		51.5	15.6	5.1	
CD (P = 0.05)	30.4	9.3	3.0		20.1	8.4	2.7	

Table 2 Effect of herbicides on vegetative and floral characters in gladiolus var. White Prosperity

Treatment	Plant height (cm)	Spike Length (cm)	Rachis length (cm)	Days to first floret opening	Diameter of second floret (mm)	Number of florets / spike	Number of florets open at a time	Number of leaves/ plant
Atrazin-1.0 kg a.i./ha	95.7	79.1	43.1	122.0	97.8	12.6	5.2	6.2
Atrazin-1.5 kg a.i./ha	106.4	90.7	52.3	121.1	97.2	11.5	5.1	6.3
Metribuzin-0.25 kg a.i./ha	103.0	93.2	49.3	122.0	93.9	12.0	5.4	6.4
Metribuzin-0.50 kg a.i./ha	87.8	75.6	38.0	126.7	96.0	9.8	5.2	6.3
Butachlor-1.0 kg a.i./ha	98.4	83.8	37.9	124.9	97.2	11.0	4.9	6.5
Butachlor-1.5 kg a.i./ha	88.4	75.4	40.5	126.6	90.4	9.6	5.3	6.2
Pendimethalin-0.75 kg a.i./ha	107.4	94.8	52.9	125.6	96.9	12.1	5.3	6.6
Pendimethalin-1.0 kg a.i./ha	112.9	98.3	58.8	122.7	92.5	14.1	5.2	6.3
Control (unweeded)	76.7	79.3	36.3	122.5	99.0	9.1	4.8	6.3
Control (weed free)	111.5	91.9	57.1	117.1	93.8	14.2	5.2	6.5
CD (P = 0.05)	22.3	15.1	14.4	4.1	NS	4.3	0.5	NS

cm) and rachis length (58.8 cm) whereas, minimum spike length (75.4 cm) and rachis length (55.8 cm) were recorded in Butachlor 1.5kg a.i./ha and in unweeded control, respectively. Similar results were also reported by Arora *et al.* (2002). No harmful effect of Pendimethalin was also observed by Bing *et al*. (1988) on gladiolus. The number of florets/spike was significantly higher in weed free control (14.2) followed by Pendimethalin @ 1.0 kg a.i./ha (14.1) and lowest was found in unweeded control (9.1). The significantly minimum days to first floret opening was recorded in weed free control (117.1) and maximum (126.7 days) was found in Metribuzin @ 0.50 kg a.i./ha. This could be because of least competition by the weeds in the weed free plots which makes available the required nutrients, air and free space to crop plants. The maximum number of florets opened at a time was found in Metribuzin @ 0.50 kg a.i./ha (5.4), whereas lowest was recorded in unweeded control (4.8). The flower diameter and number of leaves/ plant were not affected significantly by application of herbicides. From the results it is clear that in unweeded control, the crop might have been adversely affected by weeds due to heavy competition for nutrients, water, light, vertical and horizontal space which leads to poor growth and unacceptable quality.

Effect on corms and cormels production

In both seasons Atrazine @ 1.0 kg a.i./ha resulted insignificantly higher corms/plant (1.5) and corm diameter (42.1 mm) (Table 3). The highest average corm weight (21.3 g) was also recorded in Atrazine @ 1.5 kg a.i./ha whereas, the lowest corm weight (8.4 g) and corm diameter (30.6 mm) were recorded in Metribuzin @ 0.50 kg a.i./ha. Significantly higher number of cormels/plant (28.6) and weight of cormels/plant (8.1 g) were found in Pendimethalin @ 1.0 kg a.i./ha and Atrazine @ 1.5 kg a.i./ha, respectively. Application of Atrazine reduced weed competition and Pendimethalin proved effective in promoting crop growth, which provided a favourable environment for growth and there by resulted in more number of corms/plant and highest average corm weight. The results of present investigation are in line with that of results reported by Manuja *et al.* (2005). The lowest number and weight of cormels were found in Atrazine @ 1.0 kg a.i./ha (6.9 and 2.4 g/plant, respectively). This could be due to the residual effect of Atrazine on development of small cormels. Since management of weeds at critical stages of gladiolus development is crucial, present study concludes that pre-emergence application of Atrazine and Pendimethalin is beneficial in reducing weed count and improving the crop

Table 3 Effect of herbicides on corm characters in gladiolus var. White Prosperity

Treatment	No. of corms/ plant	Diameter of corm (mm)	Weight of corm (g)	Number of cormels/plant	Weight of cormels/plant (g)
Atrazin-1.0 kg a.i./ha	1.5	42.1	19.1	6.9	2.4
Atrazin-1.5 kg a.i./ha	1.0	40.0	21.3	27.2	8.1
Metribuzin-0.25 kg a.i./ha	1.0	37.7	12.5	18.5	3.5
Metribuzin-0.50 kg a.i./ha	1.1	30.6	8.4	21.5	6.7
Butachlor-1.0 kg a.i./ha	1.1	36.3	17.6	14.2	5.5
Butachlor-1.5 kg a.i./ha	1.0	34.6	9.9	19.2	4.1
Pendimethalin-0.75 kg a.i./ha	1.0	36.9	15.0	18.0	5.7
Pendimethalin-1.0 kg a.i./ha	1.1	37.2	12.7	28.6	6.3
Control (unweeded)	1.0	34.7	17.1	10.5	5.0
Control (weed free)	1.1	33.5	11.5	18.3	4.3
CD (P = 0.05)	0.4	9.3	12.6	15.0	3.1

growth and also these herbicides had no harmful effect on growth, flowering and corm parameters.

REFERENCES

Arora J S, Kushal S, Kundra H C, Singh K, Mishra R L and Sanyat M. 2002. Effect of pre-emergence herbicides in gladiolus plantings. Floriculture research trend in India. (In) *Proceedings of the National Symposium on Indian Floriculture in the new millennium*, 25–27 February 2002, Lal Bagh, Bangalore, pp 122–5.

Bing A, Senesac A F and Macksel M. 1988. Pre-emergence weed control in gladiolus cormel production. *Proceedings of the 42nd Annual Meeting of Northeastern Weed Science Society*, USA, pp 137–40.

Chahal D S, Sehgal O P and Singh K K. 1994. Effect of chemical and agronomic treatments on population and growth of weeds in gladiolus field. *Annals of Biology* (Ludhiana) **10**(2): 245–9.

Dufus J E. 1971. Role of weeds in incidence of viral diseases. *Annual Review of Phytopathology* **9**: 319–40.

Gomez K A and Gomez A A.1984. *Statistical Procedures for Agricultural Research*, Second Ed, p 680. Wiley, Singapore.

Manuja S, Ram R, Singh R D and Mukherjee D. 2005. Evaluation of different herbicides for protection of gladiolus (*Gladiolus* spp.) crop from weeds. *Crop Protection* **24**(10): 921–6.

Sidek Z, Barin J and Suleiman I. 1999. Weed hosts of cucurbit viruses. *Agro-Search* **6**(1): 1–3.

Yadav I P and Bose T K. 1987. Chemical weed control in tuberose and gladiolus. *Acta Horticulturale* **205**: 177–85.