Short communication

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Chemical weed management in *Chrysanthemum*

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Chrysanthemum (*Chrysanthemum morifolium* Ramat.) is one of the most widely cultivated herbaceous perennial flowering plant belonging to family Asteraceae and commonly known as 'Autumn Queen' or 'Queen of East'. *Chrysanthemum* produces showy flowers with different flower colour, flower shape and plant height that can be used as pot plants for beautifying indoors and outdoors, as cut flowers for making bouquets and base decoration, as loose flower for making garlands, worshipping purpose and for garden decoration. It contributes largely to the floriculture industry by virtue of its yield potential, colour variation and long life (Mukherjee 2008).

The growth of the plants and flower yield depends on the cultivation practices adopted and weed free environment right from the early stage. Weeds are unwanted and undesirable plants which interfere with the utilization of land and water resources, thus adversely affect plant growth, human welfare and also harbor insect and disease pests (Rao 2000). Timely hand weedings are not practiced on a large scale, as labour is scarce, costly and time consuming. Incessant rains during initial periods often render the hand-weeding impossible. Hence, an alternative method would be to use herbicides which are practically effective and economical in reducing weed competition at right time so that it is possible to obtain higher flower yield. Thus, the use of herbicides in controlling weeds is comparatively economical, convenient and efficient by one or two applications (Yadav and Bose 1987).

A number of herbicides have become available in the market for control of weeds in flower crops. However, detailed information on this choice of herbicides, their appropriate dosage and time of application is not fully standardized to the farmers usage. In the present study, an attempt was made to find out an effective weed management practice in chrysanthemum.

An experiment was carried out during 2013-14 at the research farm of Floriculture and Landscaping, Punjab Agricultural University, Ludhiana. Soil of the experimental site was sandy loam in texture. Eleven treatments comprising of different pre-emergence herbicides, *viz.* butachlor 1.0 kg/ha, butachlor 1.0 kg/ha + 2 hand weedings, butachlor 1.5 kg/ha, pendimethalin 0.75 kg/ha, pendimethalin 0.75 kg/ha + 2 hand weedings, pendimethalin 1.0 kg/ha and atrazine 1.0 kg/ha, atrazine 1.0 kg/ha + 2 hand weedings, atrazine 1.5 kg/ha besides weed-free (where plots were kept weed free with regular hand weeding) and weedy check (where no cultural practices were followed to control weeds) as control were laid out in randomized block design.

The healthy terminal rooted cuttings (5-7 cm) of *Chrysanthemum* cv. "*Garden Beauty*", free from symptoms of any disease or insect pest were prepared during mid of June and then planted in propagating plug trays having burnt rice husk as rooting media. Plug trays were kept moist by sprinkling water to ensure satisfactory rooting of cuttings. New roots developed after 15-20 days. After the application of herbicides the plots were kept undisturbed till transplanting of rooted cuttings. Terminal rooted cuttings were transplanted in field in the first week of August for further evaluation. Planting of *Chrysanthemum* was done at a spacing of 30 x 30 cm having plot size of 1.2 m x 1.2 m. All the recommended package of practices such as hoeing, irrigation, application of fertilizers and adequate crop protection measures against pests and diseases were followed to get good plant growth and quality flower production. Pinching operation was practiced at two stages *i.e.* first at four weeks after transplanting and second at seven weeks after transplanting to encourage the emergence of lateral shoots.

To record observations on weed count, weeds removed from 50 x 50 cm quadrat, thrown randomly in each plot at 30 and 60 days after application of herbicides, was considered. After counting, the weeds they were oven dried for 48 h at 50°C and dry weight was recorded. Weed species like *Poa annua*, *Digitaria sanguinalis*, *Eragrostis tanella*, *Cyperus rotundus*, *Phyllanthus niruri* and *Parthenium hysterophorus*

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were found in experimental plot. Weed control efficiency (WCE) was calculated on dry weight basis.

Results revealed that all the herbicides showed significant effect on controlling weed population. Butachlor 1.0 kg/ha + 2 HW registered minimum weed population (8.31/m^2), (9.77 /m^2) at 30 and 60 days after transplanting (DAT), respectively. Reduction in weed population in these treatments can be attributed to relatively better management practices which shifted the competition in favour of *Chrysanthemum*. Similar results confirming the findings of the present study were obtained in gladiolus (Kumar *et al.* 2012). The number of weeds per unit area (m^2) in weed free treatment both at 30 and 60 days after transplanting was nil, where plots were kept weed free with regular hand weeding. The less number of weeds in weed free treatment were due to better availability of nutrients, moisture, sunlight and space for crop growth. This is in conformity with the findings of Basavaraju *et al.* (1992) in China aster, Pal and Das (1990) in tube rose and Koutepas (1982) in gladiolus. The minimum weed fresh matter (11.83 g/m^2) and (13.51 g/m^2) was recorded from butachlor treatment of 1.0 kg/ha + 2 HW suggesting that the best weed control was given by this treatment at 30 and 60 days after transplanting. It was quite closely followed by pendimethalin 0.75 kg/ ha + 2 HW and atrazine 1.0 kg/ha + 2 HW. All the treatment differed significantly with each other with regard to weed parameters (Table 1.)

At 30 DAT, lowest weed dry matter (4.87g/m^2) was recorded from butachlor 1.0 kg/ ha + 2 HW followed by atrazine 1.0 kg/ha + 2 HW (4.54g/m^2) and pendimethalin 0.75 kg/ha + 2 HW with (5.27g/m^2). Similar trend was followed for dry matter at 60 DAT with the values of 5.04 g/m^2, 5.66 g/m^2 and 6.34 g/m^2, respectively. Reduction in weed population and weed dry weight in herbicidal treatments with hand weedings can be attributed to relatively better management practices and proved to be economical weed management practice which shifted the competition. There was significant enhancement in weed control efficiency (100%) with weed free treatment (plot that was kept weed free throughout the crop growth period through manual weeding) followed by application of butachlor 1.0 kg/ha + 2 hand weeding (84.47%), which was significantly superior to weedy check (0.0%). The crop plants in the former treatments experienced good vegetative growth right from the early stages up to the end of cropping period because of less competition of weeds for nutrients, water, space and sunlight (Kumar *et al.* 2012). Similar were the findings of Singh and Bijimol (1999) and Patil and Shalini (2006).

The crop plants in the former treatments experienced good vegetative growth right from the early stages up to the end of cropping period because of less competition of weeds for nutrients, water, space and sunlight. Application of butachlor 1.0 kg/ha + 2 hand weeding proved to be economical weed management practice. Similar findings were obtained by Singh and Bijimol

Table 1. Effect of different pre-emergence herbicides on weed dynamics of *Chrysanthemum*

Treatment	Weed count (per m^2)		Fresh weight (g/m^2)		Dry weight (g/m^2)		Weed control efficiency (%) 60 DAT
	30 DAT	60 DAT	30 DAT	60 DAT	30 DAT	60 DAT	
Butachlor 1 kg/ha	13.2 (175)	14.3 (205)	18.5 (347)	19.6 (386)	8.5 (73)	8.7 (75)	53.4
Butachlor 1 kg/ha + 2 hand weedings (at monthly interval)	8.3 (69)	9.8 (95)	11.8 (141)	13.5 (182)	4.9 (24)	5.0 (25)	84.5
Butachlor 1.5 kg/ha	10.9 (119)	10.3 (105)	15.3 (233)	14.1 (198)	6.4 (41)	6.5 (41)	74.5
Pendimethalin 0.75 kg/ha	13.7 (189)	15.6 (244)	19.3 (373)	21.4 (458)	8.9 (80)	9.7 (95)	41.0
Pendimethalin 0.75 kg/ha + 2 hand weedings (at monthly interval)	8.5 (72)	10.1 (101)	11.8 (141)	13.8 (190)	5.3 (27)	6.3 (39)	75.8
Pendimethalin 1.00 kg/ha	10.6 (112)	12.0 (144)	14.8 (219)	16.5 (270)	6.5 (42)	7.5 (56)	65.2
Atrazine 1.0 kg/ha	13.4 (181)	14.2 (201)	18.9 (359)	19.5 (378)	8.9 (79)	8.6 (74)	54.0
Atrazine 1.0 kg/ha + 2 hand weedings (at monthly interval)	8.4 (71)	10.2 (104)	12.0 (145)	14.0 (195)	4.5 (20)	5.7 (32)	80.1
Atrazine 1.5 kg/ha	10.8 (117)	11.6 (135)	15.1 (230)	15.9 (253)	6.6 (43)	7.3 (52)	67.7
Weed free	1.0 (0)	1.0 (0)	1.0 (0)	1.0 (0)	1.0 (0)	1.0 (0)	100.
Weedy (control)	17.6 (309)	19.6 (384)	24.5 (602)	26.8 (720)	12.0 (143)	12.7 (161)	0.00
LSD (P=0.05)	2.02	1.40	2.80	1.91	1.78	1.15	

Original values are given in parentheses; DAT=Days after transplanting; HW= Hand weeding

(1999) and Patil and Shalini (2006). Herbicides also showed better control of weeds was due to their effectiveness in controlling and weeds and recorded comparatively higher weed control efficiency due to lower dry weight of weeds as compared to weedy control.

SUMMARY

A field experiment was laid out in randomized block design with eleven treatments comprising of ifferent pre-emergence herbicides, *viz.* butachlor 1.0 kg/ha, butachlor 1.0 kg/ha + 2 hand weedings, butachlor 1.5 kg/ha, pendimethalin 0.75 kg/ha, pendimethalin 0.75 kg/ha + 2 hand weedings, pendimethalin 1.0 kg/ha and atrazine 1.0 kg/ha, atrazine 1.0 kg/ha + 2 hand weedings, atrazine 1.5 kg/ha besides weed-free (where plots were kept weed free with regular hand weeding) and weedy check (where no cultural practices were followed to control weeds) as control. Results revealed a significant enhancement in flower yield with weed free and butachlor 1.0 kg/ha + 2 hand weedings which were superior over weedy check. The highest weed control efficiency (100%) was also observed in weed free treatment, followed by butachlor 1.0 kg/ha + 2 hand weedings (84.5%) and atrazine 1.0 kg/ha + 2 hand weedings (80.1%). Application of butachlor 1.0 kg/ha along with hand weedings proved to be economical.

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