Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; 8(6): 2418-2421
Received: 12-09-2019
Accepted: 15-10-2019

TC Mahawar
Ph.D. Scholar, Department of Horticulture, RCA Campus, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan, India

LN Mahawer
Professor and PI, AICRP on Floriculture, Department of Horticulture, RCA Campus, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan, India

SL Mundara
Professor, Department of Agronomy, RCA Campus, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan, India

B Upadhyay
Professor, Department of Statistics, RCA Campus, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan, India

Corresponding Author:
TC Mahawar
Ph.D. Scholar, Department of Horticulture, RCA Campus, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan, India

Effect of weed control treatments on weeds, vase life and yield parameters of tuberose (*Polianthes tuberosa* L.)

TC Mahawar, LN Mahawer, SL Mundara and B Upadhyay

Abstract
A field experiment was conducted at the AICRP on Floriculture Unit, Horticulture Farm, Department of Horticulture, Rajasthan College of Agriculture, Udaipur. The experiment consisted with fourteen treatments comprising of hand weeding, herbicides and weedy check replicated thrice in randomized block design. In the present investigation the pre emergence application of pendimethelin @ 1 kg/ha showed significantly lowest weed population, fresh weight and dry weight of weeds with highest weed control efficiency at 25 DAP (17.51, 25.07 g, 7.25 g and 82.69 % m^{-2}) and pendimethelin @ 0.75 kg/ha + 1 HW (at 40 days), at 50 DAP (13.80, 21.70 g, 3.65 g and 92.38 % m^{-2}), while the 3 HW at 30, 60 and 90 days interval at 75 DAP (8.39, 19.30 g, 4.82 g and 90.19 % m^{-2}) as compared to other treatments. Whereas, 3 HW at 30, 60 and 90 DAP had superior effect on the vase life (8.83 days), water uptake (59.91 ml), flower yield ha^{-1} (9,566 kg), spike yield ha^{-1} (338000) and bulb yield ha^{-1} (740491). After the hand weedind, pendimethelin @ 0.75 kg/ha + 1 HW at 40 days had superior effect on vase life and yield parameters as compared to other treatments.

Keywords: Tuberose, Hand weeding, Herbicide, Weedy check, Vase life, Water uptake

Introduction
Tuberose (*Polianthes tuberosa* L.) commonly known as 'Rajanigandha' belongs to family Amaryllidaceae and native to Mexico from where it spread to different parts of the world. It is believed that tuberose was brought to India via Europe in 16th century. It is commercially propagated by bulbs and generally, bulbs diameter ranges between 1.5 to 2.5 cm are suitable for planting. Tuberose is cultivated on large scale in France, South Africa, North Carolina, USA, tropical and subtropical areas in India. Commercial cultivated of tuberose is mainly in Mysore, Devanhalli taluk (Karnataka), East Godavari, Guntur, Chitoor (Andhra Pradesh), Coimbatore and Madurai (Tamil Nadu), Pune, Thane, Sangli (Maharashtra), Ranaghat, Krishna Nagar (West Bengal) in India reported by Chadha and Bhattacharjee (1995) [2]. This is fact that in tuberose cultivation one of the main constrain is weed. Weeds cause irreparable damage to crops by competing for water, nutrients, light, space and also acting as alternate hosts to a number of pathogens and insect pests. Manual weeding is time consuming and costly hence, chemical weed control is one of the alternative methods to control weeds. Therefore, suitable strategy for weed control is the prime need to reduce weed competition and to improve the quality of cut spike and flower production. In the last four decades, considerable developments had taken place in chemical weed control, which can increase crop returns by reducing the production cost. Hence, combination of cultural and herbicide in various ornamental plants are effective techniques as compared to others methods of weed control. Consequently, these are moderately cheapest, appropriate and effective for removing of weeds. There is possibility to be application of herbicide with hand weeding which can be more effective and economically to reducing weed opposition at right time to obtain highest flower production in tuberose.

Material and Method
The experiment was carried out during April 2014 from March 2016 to study the weed management practices in tuberose cv. Prajwal. Fourteen treatments including namely, Pre emergence (PE) application of Pendimethalin @ 0.75 kg/ha, Pendimethalin @ 1.0 kg/ha, Pendimethalin @ 0.75 kg/ha + 1 hand weeding (HW) at 40 DAP, Oxyfluorfen @ 0.50 kg/ha, Oxyfluorfen @ 0.75 kg/ha, Oxyfluorfen @ 0.50 kg/ha + 1 HW at 40 DAP, Atrazine @ 1.0 kg/ha, Atrazine @ 1.5 kg/ha, Atrazine @ 1.0 kg/ha + 1 HW 40 DAP, Butachlor @ 1.0 kg/ha, Butachlor @ 1.5 kg/ha, Butachlor @ 1.0 kg/ha + 1 HW at 40 DAP, 3 HW at 30, 60 and 90 days interval and Weedy check (control) in Randomized Block Design, with 3 replications, at

AICRP on Floriculture Project, Horticulture Farm, RCA Campus, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan, situated at 24º35' N latitude, 73º42' E longitude and at 579.5 m above MSL altitude. Mean maximum (39.1 °C) and minimum (23.4 °C) temperature, and relative humidity of maximum (89.36 %) and minimum (41.23 %), were recorded during the experiment. Bulb of tuberose cv. 'Prajwal' were collected from AICRP on Floriculture Project Centre, MPUAT, Udaipur. All pre-emergent herbicide, which was sprayed once at 4 days before transplanting and second year before sprouting of bulb at the time of dormancy period. The required quantity of herbicides was dissolved in water and applied by foot sprayer. Herbicide, treatments were compared with hand weeding where the weeds were removed manually. Healthy and uniform sized bulb of 1.5-2.5 cm diameter were planted in the third week of April at a spacing of 30 cm x 30 cm at 5-6 cm depth. Thirty bulb of each treatment per replication were planted in each plot. The soil was clay loam in texture, with pH 7.34 and EC 0.54 dSm^{-1} under irrigated condition. Well-decomposed 2.5 kg/m^2 farm yard manure was incorporated into all the plots two weeks prior to planting. A basal fertilizer dose comprising 250 kg N_2, 200 kg P_2O_5 and 200 kg K_2O ha^{-1} was applied at planting and the remaining half dose of N 125 kg was applied 45 days after planting (Meena, 2016) [7]. Uniform cultural practices were followed throughout the experiment. The bulbs were lifted from the field when the foliage turned yellow Shade drying of bulbs was followed by cleaning, counting and weighing of bulbs for recording of desired observations. Further, bulbs were stored after treatment with fungicide for succeeding crop. Data on weed flora, vase life, water uptake, flower yield, spike/plant and bulb/plant were recorded in five randomly selected plants, and pooled values of two year were analyzed statistically. The weed population was recorded at 25 day interval with 50 cm x 50 cm quadrat, thrown randomly in the plots from two spots. All the weeds in 50 cm x 50 cm quadrat were cut from soil surfaces is above ground and put into paper bags in every plot. The fresh weight of weeds was recorded with the help of electronic weighing machine. The weed samples were sundried for 1-2 days until they lost maximum moisture. Then samples were kept in oven for 48 h at 50 °C and final dry weight was recorded. Weed control efficiency (WCE) was calculated with following formula.

$$\text{Weed control efficiency (\%)} = \frac{\text{DWC–DWT}}{\text{DWC}} \text{ X } 100$$

Where, DWC is dry weight of weeds in weedy check i.e. control and DWT is weed dry weight of treatments

Result and Discussion

(i) Weeds parameters

Weed flora observed during the crop period of tuberose was categorized as grasses, sedges and broad leaved weeds. Observations were recorded on weed count per m^2 area, fresh weight or dry weight of weeds at 25 days interval and weed control efficiency. Among the grasses, *Cynodon dactylon and Echinochloa colona* was predominant and only sedge observed was *Cyperus rotundus* and the minimum weed count was noted for *Portulaca quadrifoliara* followed by *Convolvulus arvensis*. In the present investigation the pre emergence application of Pendimethelin @ @ 1 kg/ha showed significantly lowest weed population, fresh weight and dry weight of weeds with highest weed control efficiency at 25 DAP (17.51, 25.07 g, 7.25 g and 82.69 % m^{-2}) and pendimethelin @ 0.75 kg/ha + 1 HW (40 days) at 50 DAP (13.80, 21.70 g, 3.65 g and 92.38 % m^{-2}). Whereas, the 3 HW at 30, 60 and 90 days interval at 75 DAP (8.39, 19.30 g, 4.82 g and 90.19 % m^{-2}) as compared to other treatments. However, the weedy check i.e. control plots produced highest weeds population, fresh weight of weeds, dry weight of weed with lowest weed control efficiency at 25 DAP (73.89/m^2), (117.78 g/m^2), (41.89 g/m^2), (0.00 % m^{-2}), at 50 DAP (84.14/m^2), (122.43 g/m^2), (47.87 g/m^2), (0.00 % m^{-2}) and at 75 DAP (87.42/m^2), (123.72 g/m^2), (49.17 g/m^2), (0.00 % m^{-2}), respectively.

At 25 DAP, the population of weeds, fresh weight of weeds and dry weight of weed were found minimum with the upper dose of the herbicidal treatment i.e. pre emergence application of pendimethalin @ 1 kg/ha. This may be due to the reason that herbicides at higher rates had longer persistence and showed a good control of weeds for longer period. This could be attributed to the fact that application of pendimethalin might have caused the death of relative weeds from starvation and oxidative damage caused by break down in electron transport process because of the herbicide functions by binding to the plasto-quinone binding protein in photosynthesis. At 50 DAP, the herbicide treatments in combination with one hand weeding at 40 days i.e. pendimethelin @ 0.75 kg/ha (PE) + 1 HW was superior and recorded better weed suppression compared to other treatments. This might be due to the effect of pre emergence herbicides coupled with hand weeding which clearly shows that herbicides alone treatments can check the weeds to some extents, but when coupled with hand weeding, shows remarkable results. In all the cases at 75 days weeds count was more as compare to 3 HW, due to herbicidal treatment imposed upto the 60 days only. Similar finding were reported by Desai (2011) [3] in gladiolus, Bala (2017) or Kumar *et al.* (2017) [1, 5] in chrysanthemum and Jeevan *et al.* (2016) [4] in tuberose cv. Hyderabad Single.

Weed control efficiency followed similar trends like then weed dry matter. Higher weed control efficiency under these treatments can be accounted to lower dry weight of weeds in these treatments. Whereas, the lowest weed control efficiency was observed in weedy check (control) due to poor or no control of weeds. All other treatments recorded comparatively higher weed control efficiency due to lower dry weight of weeds as compared to unweeded control. The similar result suggested by Kumar *et al*. (2012) [6] in gladiolus, Jeevan *et al.* (2016) [4] in tuberose and Rathod and Venugopal (2017) [8] in tuberose cv. Prajwal.

(ii) Vase life parameters

The longest vase life and high water uptake was recorded best in treatment 3 HW at 30, 60 and 90 days interval (8.83 days and 59.91 ml) and pendimethelin @ 0.75 kg/ha + 1 HW at 40 days (8.19 days and 55.16 ml), whereas, shortest noted in weedy check (5.91 days and 44.09), respectively. The highest vase life of spike in lab condition are desirable trait rather than lowest value for the similar trait. These results might be due to better control of weeds during crop period in these treatments and also no phytotoxicity effects on the crop growth period which resulted in better growth and quality flowering. Shalini and Patil, 2006 [9], while working on gerbera observed the above treatments found superior due to the fact that the crop plants in these treatments reported good vegetative growth right from the early stages of growth period to the end of cropping period, because of less competition of

weeds for nutrients, water, space and sunlight which might have resulted in higher photosynthetic activity and higher number of florets per plant. Similar finding was also reported by Rathod and Venugopal (2017) [8] the higher vase life of the spike may be due to improved water uptake by xylem system, resulted in more cell turgidity, accumulation of carbohydrates in sink in tuberose cv. Prajwal.

(iii) Yield parameters

Among the weed management practices maximum flower yield/ha, spike/ha and bulb/ha were recorded in 3 HW at 30, 60 and 90 days interval (9566 kg, 338000 and 740491), followed by pendimethelin @ 0.75 kg/ha + 1 HW at 40 days (9312 kg, 336333, 712126)**,** whereas, minimum were observed in weedy check (5279 kg, 232833 and 435329), respectively. All these in pattern are likely to influence favorably nutrient availability and their uptake by the plants. Whereas, unweeded control recorded less flower weight per plant as well as per hectare due to higher weed density which resulted in higher competition of weeds with the crop plants that ultimately suppressed the growth and flowering of tuberose. Hand weeding at 20, 40 and 60 DAP and pendimethelin @ 0.75 kg/ha + 1 HW at 30 days play a major impact on yield parameter reported by Jeevan *et al.* (2016) [4] in tuberose cv. Hyderabad Single. Similar results were obtained by Kumar *et al.* (2012) [6] highest spike ha^{-1} with 2 HW at 20 and 40 DAT followed by pendimethalin @ 2 kg/ha + 1 HW in gladiolus and Rathod and Venugopal (2017) [8] were recorded maximum flower yield ha^{-1}, yield of spike ha^{-1} and bulb yield ha^{-1} in weed free check followed by pendimethalin 30 EC @ 1 kg a.i. /ha in tuberose cv. Prajwal.

Conclusion

From the present investigation it may be concluded that the highest weed control efficiency with remarkable increase in yield of flower yield, spike ha^{-1} and bulb ha^{-1} due to application of pendimethelin @ 1.0 kg/ha, pendimethelin @ 0.75 kg/ha + 1 HW at 40 days and 3 hand weeding at 30, 60 and 90 days interval. Manual weeding is time consuming and as the cost of labour is more hence, weed control can be done by the combination of chemical and hand weeding.

Acknowledgement

The authors would like to thank the Professor and PI, AICRP on Floriculture Unit, Department of horticulture, RCA, MPUAT, Udaipur for providing necessary facilities.

Table 1: Effect of weed management practices on weeds flora parameters at 25 DAP

Treatments	Weeds counts per m^{-2}	Fresh weight of weeds m^{-2} (g)	Dry weight of weeds m^{-2} (g)	WCE (%)
Pendimethalin 0.75 kg/ha PE	22.18 (4.76)	29.29 (5.46)	10.21 (3.27)	75.63
Pendimethalin 1.0 kg/ha PE	17.51 (4.24)	25.07 (5.06)	7.25 (2.78)	82.69
Pendimethalin 0.75 kg/ha PE + 1 HW	20.21 (4.55)	28.84 (5.41)	10.02 (3.24)	76.09
Oxyfluorfen 0.50 kg/ha PE	21.18 (4.66)	29.83 (5.51)	10.88 (3.37)	74.03
Oxyfluorfen 0.75 kg/ha PE	20.57 (4.59)	29.44 (5.47)	10.68 (3.34)	74.50
Oxyfluorfen 0.50 kg/ha PE + 1 HW	20.97 (4.63)	29.74 (5.50)	11.25 (3.43)	73.13
Atrazine 1.0 kg/ha PE	26.44 (5.18)	37.08 (6.12)	14.41 (3.86)	65.60
Atrazine 1.5 kg/ha PE	25.78 (5.12)	36.09 (6.05)	14.01 (3.81)	66.55
Atrazine 1.0 kg/ha PE + 1 HW	26.35 (5.18)	36.23 (6.06)	14.21 (3.83)	66.09
Butachlor 1.0 kg/ha PE	27.56 (5.30)	38.76 (6.27)	17.15 (4.20)	59.06
Butachlor 1.5 kg/ha PE	26.51 (5.19)	38.03 (6.21)	15.33 (3.98)	63.39
Butachlor 1.0 kg/ha PE + 1 HW	27.56 (5.30)	38.15 (6.22)	18.85 (4.40)	54.99
3 HW at 30, 60 and 90 days interval	59.59 (7.75)	106.64 (10.35)	37.83 (6.19)	9.69
Weedy check (control)	73.89 (8.62)	117.78 (10.88)	41.89 (6.51)	0.00
SEm $\pm$	0.07	0.06	0.04	1.08
CD at 5 %	0.20	0.17	0.11	3.07
CV %	3.71	2.65	2.79	5.10

* The data in parenthesis represent the transformed values of square root (n+0.5)

Table 2: Effect of weed management practices on weeds flora parameters at 50 DAP

Treatments	Weeds counts per m^{-2}	Fresh weight of weeds m^{-2} (g)	Dry weight of weeds m^{-2} (g)	WCE (%)
Pendimethalin 0.75 kg/ha PE	22.48 (4.79)	29.49 (5.48)	10.39 (3.30)	78.30
Pendimethalin 1.0 kg/ha PE	21.85 (4.73)	28.10 (5.34)	7.71 (2.86)	83.90
Pendimethalin 0.75 kg/ha PE + 1 HW	13.80 (3.78)	21.70 (4.71)	3.65 (2.03)	92.38
Oxyfluorfen 0.50 kg/ha PE	24.14 (4.96)	32.19 (5.72)	11.23 (3.42)	76.53
Oxyfluorfen 0.75 kg/ha PE	23.85 (4.93)	31.12 (5.62)	10.87 (3.37)	77.29
Oxyfluorfen 0.50 kg/ha PE + 1 HW	15.06 (3.94)	21.91 (4.73)	6.39 (2.62)	86.66
Atrazine 1.0 kg/ha PE	28.15 (5.35)	37.70 (6.18)	15.39 (3.99)	67.85
Atrazine 1.5 kg/ha PE	26.88 (5.22)	36.55 (6.09)	14.69 (3.90)	69.31
Atrazine 1.0 kg/ha PE + 1 HW	15.42 (3.99)	22.24 (4.77)	6.53 (2.65)	86.36
Butachlor 1.0 kg/ha PE	31.75 (5.68)	42.61 (6.56)	18.91 (4.41)	60.49
Butachlor 1.5 kg/ha PE	30.75 (5.59)	41.51 (6.48)	18.22 (4.33)	61.95
Butachlor 1.0 kg/ha PE + 1 HW	16.80 (4.16)	23.88 (4.94)	7.11 (2.76)	85.14
3 HW at 30, 60 and 90 days interval	17.10 (4.19)	24.03 (4.95)	7.64 (2.85)	84.03
Weedy check (control)	84.14 (9.20)	122.43 (11.08)	47.87 (6.95)	0.00
SEm $\pm$	0.04	0.06	0.03	0.40
CD at 5 %	0.12	0.16	0.09	1.15
CV %	2.46	2.72	2.62	1.58

* The data in parenthesis represent the transformed values of square root (n+0.5)

Table 3: Effect of weed management practices on weeds flora parameters at 75 DAP

Treatments	Weeds counts per m^{-2}	Fresh weight of weeds m^{-2} (g)	Dry weight of weeds m^{-2} (g)	WCE (%)
Pendimethalin 0.75 kg/ha PE	23.76 (4.92)	30.78 (5.59)	11.68 (3.49)	76.25
Pendimethalin 1.0 kg/ha PE	23.13 (4.86)	29.39 (5.47)	9.01 (3.08)	81.69
Pendimethalin 0.75 kg/ha PE + 1 HW	15.08 (3.94)	22.99 (4.84)	4.93 (2.32)	89.98
Oxyfluorfen 0.50 kg/ha PE	25.43 (5.09)	33.47 (5.83)	12.52 (3.61)	74.54
Oxyfluorfen 0.75 kg/ha PE	25.13 (5.06)	32.41 (5.74)	12.16 (3.56)	75.26
Oxyfluorfen 0.50 kg/ha PE + 1 HW	16.34 (4.10)	23.19 (4.87)	7.68 (2.86)	84.38
Atrazine 1.0 kg/ha PE	29.42 (5.47)	38.98 (6.28)	16.68 (4.14)	66.08
Atrazine 1.5 kg/ha PE	28.17 (5.35)	37.84 (6.19)	15.98 (4.06)	67.51
Atrazine 1.0 kg/ha PE + 1 HW	16.70 (4.15)	23.52 (4.90)	7.82 (2.88)	84.11
Butachlor 1.0 kg/ha PE	33.03 (5.78)	43.90 (6.66)	20.20 (4.55)	58.92
Butachlor 1.5 kg/ha PE	32.02 (5.70)	42.80 (6.58)	19.50 (4.47)	60.33
Butachlor 1.0 kg/ha PE + 1 HW	18.08 (4.31)	25.16 (5.06)	8.40 (2.98)	82.93
3 HW at 30, 60 and 90 days interval	8.39 (2.98)	19.30 (4.45)	4.82 (2.30)	90.19
Weedy check (control)	87.42 (9.38)	123.72 (11.15)	49.17 (7.05)	0.00
SEm ±	0.04	0.03	0.04	0.49
CD at 5 %	0.12	0.07	0.11	1.40
CV %	2.43	1.25	3.04	1.97

* The data in parenthesis represent the transformed values of square root (n+0.5)

Table 4: Effect of weed control treatments on vase life and yield parameters

Treatments	Vase life (Days)	Water uptake (ml)	Flower yield ha^{-1}	Spikes ha^{-1}	Bulbs ha^{-1}
Pendimethalin 0.75 kg/ha PE	7.55	50.86	7545	292167	830772
Pendimethalin 1.0 kg/ha PE	7.66	51.22	7943	305833	622505
Pendimethalin 0.75 kg/ha PE + 1 HW	8.19	55.16	9312	336333	712126
Oxyfluorfen 0.50 kg/ha PE	6.74	50.50	6919	284500	578639
Oxyfluorfen 0.75 kg/ha PE	6.98	51.23	7817	304000	613588
Oxyfluorfen 0.50 kg/ha PE + 1 HW	7.92	52.67	8552	320167	676067
Atrazine 1.0 kg/ha PE	6.89	50.15	6960	278167	604616
Atrazine 1.5 kg/ha PE	7.01	50.57	7479	291833	608484
Atrazine 1.0 kg/ha PE + 1 HW	7.88	52.63	8139	308833	630520
Butachlor 1.0 kg/ha PE	6.22	47.93	6479	267500	537877
Butachlor 1.5 kg/ha PE	6.61	50.03	6897	270833	545223
Butachlor 1.0 kg/ha PE + 1 HW	7.87	51.68	8031	306500	598275
3 HW at 30, 60 and 90 days interval	8.83	59.91	9566	338000	740491
Weedy check (control)	5.91	44.72	5279	232833	435329
SEm ±	0.13	0.91	225.25	6513.00	29542.49
CD at 5 %	0.37	2.59	639.23	18482.77	85878.75
CV %	4.99	5.02	8.34	6.23	6.56

References

1. Bala M. Weed management effect on vegetative growth and flowering parameters of chrysanthemum. Indian Journal of Weed Science. 2017; 49(3):303-305.
2. Chadha KL, Bhattacharjee SK. Cultural requirement of tuberose. In: Advancces in Horticulture Part I Ornamental Crops. Malhotra Publishing House, New Delhi, 1995, 725-741p.
3. Desai S. Influence of different herbicides on weed control, growth, flowering and yield of gladiolus (*Gladiolus grandiflorus* L.) cv. 'White Prosperity'. M.Sc. (Horticulture) thesis submitted to Andhra Pradesh Horticultural University, Rajendra Nagar, Hyderabad, Telangana, 2011.
4. Jeevan U, Padmavathamma AS, Halesh GK, Nayan DG, Bhagya HP. Effect of different weed control treatments on growth, yield parameters and studies on effect of herbicides on soil micro-organisms in tuberose (*Polianthes tuberosa* L.). Research in Environment and Life Sciences. 2016; 9(6):663-665.
5. Kumar A, Kumar M, Ghosh S, Tewari T, Bhardwaj SB. Effect of weed management practices in chrysanthemum (*Dendranthema grandiflora* T.) under tarai conditions of Uttarakhand. International Journal of Current Microbiology and Applied Sciences. 2017; 6(8):3028-3034.
6. Kumar A, Sharma BC, Kumar J. Integrated weed management in gladiolus. Indian Journal of Weed Science. 2012; 44(3):181-182.
7. Meena RK. Standardization of NPK, their uptake and staggered planting in tuberose (*Polianthes tuberosa* L.). Ph.D. (Horticulture) thesis submitted to MPUAT, Udaipur, Rajasthan, 2016.
8. Rathod A, Venugopal CK. Weed management studies in tuberose (*Polianthes tuberosa* L.) cv. Prajwal. J. Farm Sci. 2017; 30(1):100-103.
9. Shalini M, Patil VS. Effect of different methods of weed management in commercial growing of gerberas. Karnataka Journal of Agriculture Sciences. 2006b; 19(3):746-748.