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INTEGRATED WEED MANAGEMENT STUDIES AND IMPACT OF PRE EMERGENT HERBICIDES ON SOIL MICRO ORGANISMS IN TUBEROSE (*POLIANTHES TUBEROSA* L.)

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ABSTRACT

Weed management is an important operation in tuberose cultivation. Study was conducted to know the effect of herbicides, paddy straw mulch and black polythene sheet mulch on growth, flowering and yield parameters of tuberose cv. Hyderabad Single and impact of different herbicides on soil microbial load. Highest plant height (48.11 cm), number of leaves per plant (38.26), SPAD value (64.50), spike length (44.10 cm), floret length (6.01cm), flower yield (7215 kg ha^{-1}) and weed control efficiency (97.58%) was observed in plot mulched with black polythene. Whereas, highest leaf area (63.75 cm^2) was observed in paddy straw mulched plot. Minimum number of days for flowering and maximum number of flowers per plant obtained in pendimethalin followed by hand weeding. Thus, adoption of suitable weed management through black polythene mulch or use of herbicide pendimethalin was better and also safer for soil microbes then atrazine and oxyflourfen.

KEY WORDS
Black polythene sheet
Herbicides
SPAD Value, Weed control efficiency,
Weed index, cfu count

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INTRODUCTION

Tuberose (*Polianthes tuberosa* L.), a member of family Amaryllidaceae, was originated in Mexico and is grown on large scale in Asia. It is an important cut flower and also loose flower crop from aesthetic as well as commercial point of view. The growth and yield of the plant depends on the cultivation practices followed and among different cultural practices, weed management is an important operation. Usage of herbicides is the common practice being followed in India to control the weeds for effective crop production. Weeds are one of the main limiting factors for the poor yield and quality of flowers. Weeds cause heavy damage to crop by competing with them for water, nutrients, light and space besides acting as alternate hosts to a number of pathogens and insect pests. So, now-a-days herbicides are becoming integral part of intensive horticulture due to non availability of labour. Weeds pose a great problem by competing with the crop plant for water, light and nutrients leading to considerable yield losses (Vijaykumar Kori and Patil, 2003). Hence, a clean and weed free environment is one of the aspects of their modern farming. However, it is difficult to employ labour for weeding. It will increase the cost of cultivation, which upsets successful commercial flower production. An alternative method would be use of herbicides which offer a practically effective and economic means of reducing weed competition at right time by which it is possible to obtain higher flower yield. Control of weeds by using chemicals is economical, convenient and labour saving compared to hand weeding. Another alternate approach of weed control is through organic mulch which is eco-friendly in nature (Singh and kavitha, 2005). It also improves soil fertility and moisture by reducing weed competition. Apart from weed controlling effect, they also greatly impact on soil microorganisms (fungi and bacteria) some herbicides have adverse effects on benificial micro organisms (Selvamani and Sankaran 1993). These microorganisms are very much essential for various biological processes, during the crop growth period. So keeping all these in concern, soil microbial study was conducted only with different pre emergent herbicides like pendimethalin, atrazine and oxyfluorfen.

MATERIALS AND METHODS

Work was carried out at All India Coordinated Research Project on Floriculture, Floriculture Research Station, Agricultural Research Institute, Rajendranagar, Hyderabad during 2014-2015. The experiment was laid out in a randomized

block design with ten treatments like oxyfluorfen (pre-emergent) @ 0.15 kg *a.i.* ha^{-1} followed by quizalofop ethyl (post emergent) @ 50 g *a.i.* ha^{-1} 30 DAP (T_1), atrazine (pre-emergent) @ 1.0 kg *a.i.* ha^{-1} followed by quizalofop ethyl (post emergent) @ 50 g *a.i.* ha^{-1} 30 DAP (T_2), oxyfluorfen (pre-emergent) @ 0.15 kg *a.i.* ha^{-1} followed by hand weeding at 30 DAP (T_3), atrazine (pre-emergent) @ 1.0 kg *a.i.* ha^{-1} followed by hand weeding at 30 DAP (T_4), pendimethalin (pre-emergent) @ 0.75 kg *a.i.* ha^{-1} followed by quizalofop ethyl (post emergent) @ 50 g a.i. ha^{-1} (T_5), pendimethalin (pre emergent) @ 0.75 kg a.i. ha^{-1} followed by one hand weeding at 30 DAT (T_6), Black polyethylene sheet mulch 30 micron thickness (T_7), Paddy straw mulch (T_8), Hand weeding @ 20, 40 and 60 DAP (T_9) and Unweeded control (T_{10}). The pre emergent herbicides were sprayed on 3rd day after planting when the bulbs are before sprouted. On the same day only organic and inorganic mulch also laid on the respective plots. Spraying of Post emergent herbicides operation was taken on 30 days after planting in respective plots. Using measuring scale taken results in terms of plant height, flower length and spike length and by manually for number of leaves, number of flowers and days for initiation of flower. By using SPAD meter (soil and plant analyzing device) for indication of greenness in plant in terms of chlorophyll by taking readings which were recorded in the device. Using quadrant taken the weed counts by manually.

Weed control efficiency (WCE %)

The weed control efficiency was calculated on dry weight basis by adopting the following formula given by Mani *et al*. (1976).

$$\text{Weed control efficiency (\%)} = \frac{\text{Weed dry weight in control plot - Weed dry weight in treated plot}}{\text{Weed dry weight in unweeded control}} \times 100$$

Weed index (W. I. %)

Weed index is defined as the magnitude of yield reduction due to the presence of weeds in comparison to weed free plot, weed index was calculated by using the formula given by Gill and Vijaykumar (1969).

$$\text{Weed index (\%)} = \frac{X-Y}{X} \times 100$$

Where, X = Flower yield of the weed free check

Y = Flower yield from the treatment for which weed index has to be calculated.

The data were analyzed using Analysis of Variance method outlined by Panse and Sukhatme (1985). Statistical significance was tested by F value at 5 per cent level of significance. Critical difference at 0.05 levels was worked out for the effects which were significant. Data on weed count showed high variation. To make the analysis of variance more valid the data on weed count were subjected to square root transformation by using formula " x +1 (Chandel, 1984). To isolate mycoflora 1 ml of 10^{-3} dilutions was poured in to sterilized petri plates containing PDA medium. To isolate bacteria 10^{-5} dilution was poured in to sterilized petri plates. The petri plates were incubated at 26 $\pm$ 2C temperature. The plates were examined daily and colony forming units (cfu) counts were taken on third day for bacteria and fifth day for fungi with the help of 'Quebec' colony counter.

Number of cfu per gram of soil was calculated by using the formula

$$\text{Number of cfu/g of soil} = \frac{\text{Colony count on an agar plate x dilution factor}}{\text{10 g of soil dry weight}}$$

RESULTS AND DISCUSSION

Among treatments maximum plant height (48.11 cm), number of leaves (38.26) and SPAD value (64.50) was observed in the treatment black mulch (Table 1). The maximum leaf area (63.75 cm^2) was recorded in paddy straw mulch. Whereas, least plant height (29.75 cm), number of leaves (17.05), SPAD value (40.17) and leaf area (35.82 cm^2) was noticed in control plot. Reproductive characters like minimum days to spike emergence (109.07) and maximum number of flowers per plant (115.01) was observed in pendimethalin as pre emergent followed by one hand weeding treatment (Table 2). Maximum spike length (44.10 cm), floret length (6.01 cm) and floret yield (7215 kg ha^{-1}) was recorded in black mulch. Whereas, maximum days to spike emergence (140.07), minimum number of flowers per plant (4.2), spike length (20.90 cm), flower length (2.69 cm) and flower yield (2150 kg/ha) was noticed in control plot. This may be because of severe infestation of weeds that resulted in competition (Singh and Kavita 2005). The maximum observations in mulch may be due to higher soil moisture retention, suppresses weed growth

Table 1: Effect of weed control treatments on vegetative parameters

Treatments	Plant height (cm)	Number of leaves	SPAD value	Leaf area (cm^2)
T1	38.81	28.11	52.35	45.53
T2	38.27	29.13	48.25	46.18
T3	43.97	32.08	52.47	46.40
T4	44.33	33.15	54.56	48.44
T5	40.13	29.66	46.37	44.33
T6	45.98	34.24	55.91	47.39
T7	48.11	38.26	64.50	58.75
T8	45.42	36.38	54.48	63.75
T9	46.74	37.24	56.52	47.23
T10	29.75	17.05	40.17	35.82
Sem	1.55	2.89	4.76	5.43
Cd	4.61	8.58	14.14	16.10

Table 2: Effect of weed control treatments on reproductive and yield parameters

Treatments	Days to spike emergence	Number of flowers per plant	Spike length (cm)	Floret length (cm)	Flower yield (Kg ha^{-1})
T1	124.38	87.00	31.54	3.56	5020
T2	122.25	90.03	33.77	3.90	5199
T3	122.88	96.19	36.43	5.29	5550
T4	112.08	104.00	37.10	5.40	6001
T5	118.13	91.00	33.77	4.02	5233
T6	109.07	115.01	39.00	5.71	6787
T7	121.08	106.00	44.10	6.01	7215
T8	116.03	98.08	41.23	5.26	5658
T9	114.10	112.50	42.83	5.14	6792
T10	140.07	42.00	20.90	2.69	2150
Sem	2.81	5.68	0.94	0.45	166
Cd	8.36	16.87	2.80	1.34	493

Table 3: Effect of weed control treatments on weed density, dry weight, weed control efficiency and weed index

Treatments	Total weed density at 60DAP		Dry weight (gm) at 60DAP		Weed control efficiency (%)	Weed index (%)
T1	5.92	(34.00)	2.79	(6.80)	41.20	30.42
T2	5.70	(31.50)	2.77	(6.70)	45.62	27.94
T3	4.70	(21.17)	2.52	(5.37)	49.34	23.10
T4	4.57	(20.00)	2.38	(4.70)	52.80	16.82
T5	5.60	(30.33)	2.71	(6.50)	47.04	27.22
T6	4.40	(18.50)	2.36	(4.58)	54.33	6.41
T7	1.78	(2.17)	1.07	(0.14)	97.58	0
T8	3.81	(13.67)	1.72	(2.03)	50.11	21.62
T9	2.48	(5.17)	1.95	(1.50)	76.97	4.95
T10	7.68	(58.00)	3.65	(12.33)	0	70.20
Sem	0.17	0.08				
Cd	0.51	0.25				

Table 4: Effect of pre emergent herbicides for Bacteria 10^{-5}

Bacteria	Pendimethalin	Atrazin	Oxyflourfen	Control
Before spraying	99.0	99.0	99.0	99.0
After 1 day	0.7	0.0	0.0	96.0
7th day	13.0	6.0	2.0	97.0
14th day	28.7	21.0	10.0	95.0
21st day	88.3	73.0	60.0	98.0
SE(d) SE (m) CD (5%)	1.340.952.72			

Table 5: Effect of pre emergent herbicides for fungi 10^{-3}

Fungi	Pendimethalin	Atrazine	Oxyflourfen	Control
Before spraying	47.33	47.33	47.33	47.33
After 1st day	6	0.666	0	44
7th day	11.33	6.66	2.33	46
14th day	28	19	14.66	45
21st day	40.33	29.66	25	47
SE(d)SE(m)CD (5%)	0.990.722.01			

and reduction in leaching of manures and fertilizers. Al-Rawahy *et al*. (2011) noticed mulching material play a major impact on yield. Pendimethalin as pre-emergence + hand weeding produced more flowers with less weight when compared to black polythene sheet due to constant moisture and least evaporation. So keep the flowers as a fresh for longer period. Apart from this it retained to some extent causing warm and humid conditions around the plant. These results were in comparison with the findings of Chawla (2008) in African marigold, Santhosh and Binayak (2010) in rose, Solaiman *et al*. (2008) in aster, Adnan and muhammad *et al*. (2012) in *Freesia alba*, Subba reddy *et al*. (2015) and Bhujal *et al*. (2015) in tomato.

Among treatments maximum weed control efficiency (97.58 %) and minimum weed density (2.17), dry weight (0.14 gm) and weed index (0) was observed in black mulch (Table 3). Whereas, minimum weed control efficiency (0) and maximum weed density (58), dry weight (12.23) and weed index (70.20) was recorded in control. The total weed density and dry weight of weeds varied significantly among the treatments. All the weed control treatments recorded lower values of weed density and dry weight of weeds as compared to unweeded control

which recorded significantly higher weed density and dry weight of weeds at all the stages of crop growth. The detail about data of both bacteria and fungi is given in (Table 4 and 5). During first day (before spraying), the cfu count per gram of soil was 47.33 for fungi (10^{-3}) (Table 5) and for bacteria (10^{-5}) it was 99.00 (Table 4). Then, second day (after 24 hours) colonies formation was drastically reduced and colony formation was noticed only in pedimethalin (fungi 6.0 and bacteria 0.7). After 21st day the cfu counts for both fungi and bacteria were almost recovered to normal cfu count i.e equal to before spaying. Recovery was observed more in pendimethalin (40.33 and 88.3), moderate in atrazine (29.66 and 73.00) and least counts in oxyfluorfen (25 and 60). Before spraying we have noticed several benificial micro organisms. After spraying of herbicides there is a drastic reduction of cfu count in both bacteria and fungi in all the different kind of herbicides. But in case of pendimethalin slight colonies of both bacteria and fungi were noticed. In case of atrazin only fungi colonies were observed not the bacterial colonies. This impact we have seen even 7th day also. During 10th day onwards bacteria and fungi colonies slightly recovered. In 15th day almost colonies developed in all the different herbiceds. Among pre emergent herbicides, pendimethalin only observed more, and then atrazine followed by oxyflourfen. Similar findings were noticed in chilli, Adhkary *et al* (2013). In case of pendimethalin supported the colonies from intial to at the end of experiment. It means it is non toxic as compared to atrazine and oxyflourfen. Atrazine inhibit the photosystem II not the photosystem I and have toxic affect (Trebst, 2008). Therefore degradation, herbicides have toxic effects on microorganisms, reducing their abundance, activity and consequently, the diversity of their communities.

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