Research Article

Importance value indices of various weeds and their management in turf grass

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Abstract

In order to study the effect of different weed control methods, study was conducted in summer 2014 at the lawn situated in main campus of the University of Agriculture, Peshawar-Pakistan. Use of five methods comprised of five treatments including two mechanical methods (mowing and hand weeding), two herbicides {Harvester 50 EC (fluroxypyr + MCPA) and Bromoxynil 40 EC (bromoxynil + MCPA)} and a control treatment (weedy check). Data were collected on weed density m^{-2} , relative weed density, weed frequency, relative weed frequency and importance value indices of the weeds that infested the study area. Weed density was the highest ($103.95 m^{-2}$) in the mowing treatment and lowest in Bromoxynil 40 EC ($28.95 m^{-2}$). Herbicides treatments significantly affected weed density as compared to the rest of the treatments of hand weeding, mowing and weed check. Moreover, the performance of hand weeding treatment was also significantly more effective than the weedy check plots. It can be concluded that an integrated approach of combining cultural practices and chemicals can complement each other and give optimum results in weed management in turfs.

Keywords: Turf grass; Weed management practices; Peshawar

Introduction

Bermuda grass (*Cynodon dactylon* L.) is the most commonly used turf grass on athletic field because it is tolerant to traffic. It grows best in sunny location at temperatures between 80 and 95°F [1]. Provided names of turf grass cultivars of commercial importance having highly tolerance against athletic field traffic. The turf grass industry is a billion dollars industry worldwide, also having

environmental impact [2]. Bermuda grass is the main choice for growing as turf grass in the world as it is tough, requires little maintenance and can be used in broader environmental conditions due to its adaptability [3]. A lawn is the heart of a landscape and ultimate source of pleasure. The green carpet of lawn provides a realistic environment relaxing human minds. In Pakistan, Bermuda grass is the most commonly used for turf or lawn

grasses, because this grass is native to Indo-Pak subcontinent. It is very resistant to high temperatures and droughts but susceptible to frost, as its lush green color sustains yellowing during winters. Important varieties in Pakistan are “Tiftway”, “Tifgreen”, “Tifton”, “Tiftdwarf”, and “Dhaka” [4]. Nice lawn cannot only add beautiful appearance to buildings, it can also prevent soil erosion and help in heat and noise absorption. Studies also have shown that aesthetically-pleasing landscapes, including turfgrass, contribute up to 15% to home property values [5]. Weeds infestation occurs due to vehicles, animals, wind or by other means. Thus weed eradication is difficult in the lawn using culture practice in contrast of turf grass. So there is ultimate solution for weed control is the chemical control. Weeds can be divided into broadleaf, grasses and sedges [6]. Concluded that routine mowing at golf course fairway mowing height 1.3 cm suppresses purple nutsedge growth, although additional control methods are required to provide acceptable levels of control [7]. Weed management in lawn is in two ways, a) weed inhibiting practice, and b) weed eradication methods [4]. Solving weed problem in the lawn using chemicals are of two types, 1) pre emergence weed killer and 2) post emergence weed killer. Pre emergence weed killers are used for controlling tiny annual weed seedlings, while post emergence weed killer are used when the weeds are in full sprout because many weed killers are selective for example broad leaf weeds in the lawn [8]. Lawn mowing tools are of two types, the reel mower and the rotary mower. Bermuda grass should be clipped to ½ to 1 inch if its height of two to three inches. In spite of the study many researchers worked on different horticulture areas in Pakistan like olericulture, floriculture, pomology etc., but there is big deficiency of work on weed management in turf grasses. It is therefore an experiment was conducted to evaluate different techniques in turf grass

weed management with the objectives. To assess the effect of various weed management practices on weed control in lawn. To compare the impact of hand weeding and other weed management practices. The University of Agriculture Peshawar is having some beautiful landscapes, however, there is no proper weed management system in such areas, and therefore this experiment was aimed at laying down a foundation for such research on landscapes in future.

Materials and methods

The research study on the "Importance value indices of various weeds and their management in turf grass" in the agro-ecological conditions of Peshawar was conducted at the southern lawn of the University of Agriculture, Peshawar-Pakistan during late-summer 2014. A total of five treatments were used in the experiment including hand weeding, control, two herbicides (i.e. Harvester 50% EC, Bromoxynil 40% EC) a mowing treatment. The weedy check and hand weeding are always used for comparison purpose in all the weed management experimentations. The herbicide was used for the purpose of assessment of the difference of weed control efficiency between chemical and cultural methods. Among the treatments mowing is the principle factor for suppressing weed biomass. The experiment was laid out in a Randomized Complete Block Design with three replications. The data were recorded from different treatments on the following parameters i.e. weed density m^{-2} , relative weed density m^{-2} , weed frequency, relative weed frequency and importance value indices.

Results and discussion

Weed density m^{-2}

Statistical analysis 8.1 of the data (Table 1) revealed that different treatments showed non-significant effects ($P < 0.05$) on weed density m^{-2} before application. The maximum weed density (114.99 m^{-2}) was recorded in weedy check plots whereas minimum weed density of 60.96 m^{-2} was

observed in the mowing treatments, followed by the herbicide treatment (89.94 m⁻²). Similarly statistical analysis 8.1 of the data (Table 1) also indicated that different treatments showed non-significant effect (P<0.05) on weed density m⁻² 1 week after application. It means before application nothing to do. It is with objective to compare it to the rest of the data. While 1 week treatment application non-significant showing no treatment impact still. There is significant effects among the treatments at (P<0.05) on weed density m⁻² 2 week after application..The maximum weed density (103.95 m⁻²) was recorded in mowing plots whereas minimum weed density of 12.99 m⁻² was observed in the herbicide treatments. It is just because of the *Dicanthium annulatum* and *Euphorbia prostrata* rosette form. It is prevailing that treatment showing full

effects 2 week after application. The rest of the cultural practices for management were statistically at par. It is obvious from the results that herbicide (bromoxynil 40 EC) treatments performed the best; however, there are certain constraints due to which this treatment cannot be utilized everywhere. The first hurdle is that herbicide application is not eco-friendly. Hand weeding is the best but not good for larger area as it is costly and time consuming. Therefore, herbicide is only practicable if sufficient weed infestation in very large area of the lawn. Reported that a healthy turf grass can be accomplished by proper mowing [9]. There were six different weeds found in the experiment lawn. These weeds included *Dicanthium annulatum*, *Euphorbia prostrate*, *Cyprus rotundus*, *Convolvulus arvensis*, *Euphorbia hirta* and *Echinochloa crusgalli*

Table 1. Weed density m⁻² as affected by the different applied treatments

Treatment	WD before application	WD 1 wk after application	WD 2 wk after application
Hand weeding	114.99	46.980	42.99 BC
Weedy check	109.99	75.960	73.95 AB
Harvester	93.99	38.970	28.95 BC
Bromoxynil	89.94	26.940	12.99 C
Mowing	60.96	76.980	103.95 A
LSD _{0.05}	NS	NS	54.679

NS = non significant

Relative weed density

Table 2 showed highest relative weed density of *E. prostrata* followed by *C. Rotundus*. This table showed that infestation of *E.hirta*, *E.crusgalli* and *C.rotundus* is negligible in some areas of the experimental plot. It is because of the dispersal of seeds by wind or human. This table revealed that highest RWD of *E.prostrate* (23.68, 29, 5.7, 5.8 and 6.97) followed by *C.rotundus* (7.3, 2.75, 2.93, 1.97 and 2.95). The chemical effect on the *E.prostrate* is highly influenced as it is broad leaf in comparison to *C. Rotundus* and *E.crusgalli* is not more observed than *D. annulatum*. Although *C.arvensis* was

seemed in the lawn but it was discarded by the mowing like *E.hirta*. Both are broad leaf retard by chemical application is well. Although *C.arvensis* was seemed in the lawn but it was discarded by the mowing like *E.hirta*. Both are broad leaf retard by chemical application is well.

From Table 3 indicated dominate value of *E. prostrata* in all treatments except T4 (Bromoxynil) after *C.rotundus*. *E. crusgalli* was not seemed in all rather in the Bromoxynil treatment. *C.arvensis* was found in the T1 (hand weeding) only. The maximum value for *E. prostrata* is (21, 18, 21 and 26) while for *C.rotundus* is (19).

Table 2. Individual weed density, relative weed density, weed frequency, relative weed frequency and treatment average total weed density m⁻² before application of the treatment

T1 Avg. Total Weed density= 114m²	Weed density	Relative weed density	Weed frequency	Relative weed frequency
<i>Dicanthium annulatum</i>	2.6	2.28	44.33	38.88
<i>Ehorbia prostrate</i>	7	23.68a	89a	78.07a
<i>Convolvulus arvensis</i>	0	0	0	0
<i>Euphorbia hirta</i>	0	0	0	0
<i>Echinochloa crusgalli</i>	0.33	0.28	11	9.64
<i>Cyprus rotundus</i>	8.33a	7.3	44.33	38.88
T2 Avg. Total Weed density= 109m²	Weed density	Relative weed density	Weed frequency	Relative weed frequency
<i>Dicanthium annulatum</i>	1.33	1.22	33.33	30.57
<i>Ehorbia prostrate</i>	31.66a	29a	100a	91.74a
<i>Convolvulus arvensis</i>	0	0	0	0
<i>Euphorbia hirta</i>	0	0	0	0
<i>Echinochloa crusgalli</i>	0.66	0.6	22.33	20.48
<i>Cyprus rotundus</i>	3	2.75	55.66	51.06
T3 Avg. Total Weed density= 216m²	Weed density	Relative weed density	Weed frequency	Relative weed frequency
<i>Dicanthium annulatum</i>	1	0.46	33.33	15.4
<i>Ehorbia prostrate</i>	12.33a	5.7a	78a	36.11a
<i>Convolvulus arvensis</i>	0	0	0	0
<i>Euphorbia hirta</i>	0.66	0.3	22.33	10.33
<i>Echinochloa crusgalli</i>	0	0	0	0
<i>Cyprus rotundus</i>	6.33	2.93	67	31
T4 Avg. Total Weed density= 270 m²	Weed density	Relative weed density	Weed frequency	Relative weed frequency
<i>Dicanthium annulatum</i>	1.66	0.61	33	12.22
<i>Ehorbia prostrate</i>	15.66a	5.8a	100a	37a
<i>Convolvulus arvensis</i>	1	0.37	11	4
<i>Euphorbia hirta</i>	0	0	0	0
<i>Echinochloa crusgalli</i>	1	0.37	11	4
<i>Cyprus rotundus</i>	5.33	1.97	44.33	16.41
T5 Avg. Total Weed density= 282m²	Weed density	Relative weed density	Weed frequency	Relative weed frequency
<i>Dicanthium annulatum</i>	1	0.35	11	3.9
<i>Ehorbia prostrate</i>	19.66a	6.97a	89a	31.56a
<i>Convolvulus arvensis</i>	2.66	0.94	33.33	11.81
<i>Euphorbia hirta</i>	0	0	0	0
<i>Echinochloa crusgalli</i>	0	0	0	0
<i>Cyprus rotundus</i>	8.33	2.95	55.66	19.73

Table 4 prevailed the maximum value for *E.prostrata* followed by *C.rotundus* in hand weeding treatment (3,4 and 5) while in T2(control) same to *D. Annulatum* and *E. crusgalli* was not found in the treatments. *C.rotundus* is completely eradicated by chemical control as it is broad leaf weed. The population of *D. annulatum* control by hand weeding. The maximum value of RWD (28) was

observed in the weedy check while the minimum (18) in the chemical treatment. No herbicides are currently registered for pre-emergence (PRE) control of purple nutsedge in warm-season turf [10]. Pre-emergence applications of S-metolachlor are registered for control of yellow nutsedge (*Cyperus esculentus* L.), but not purple nutsedge [11].

Table 3. Individual weed density, relative weed density, weed frequency, relative weed frequency and treatment average total weed density m⁻² after 1 week application

T1 Avg. Total Weed density= 47m²	Weed density	Relative weed density	Weed frequency	Relative weed frequency
<i>Dicanthium annulatum</i>	0	0	0	0
<i>Ehorbia prostrate</i>	9.66a	21a	77.66a	165.23a
<i>Convolvulus arvensis</i>	0.33	0.7	11	23.4
<i>Euphorbia hirta</i>	1	2.12	11	23.4
<i>Echinochloa crusgalli</i>	0	0	0	0
<i>Cyprus rotundus</i>	4.46	9.48	66.66	142
T2 Avg. Total Weed density= 76m²	Weed density	Relative weed density	Weed frequency	Relative weed frequency
<i>Dicanthium annulatum</i>	2.33	3	55.66	73.23
<i>Ehorbia prostrate</i>	14a	18.4a	100a	132a
<i>Convolvulus arvensis</i>	0	0	0	0
<i>Euphorbia hirta</i>	0	0	0	0
<i>Echinochloa crusgalli</i>	0	0	0	0
<i>Cyprus rotundus</i>	2.33	3	22	29
T3 Avg. Total Weed density= 39m²	Weed density	Relative weed density	Weed frequency	Relative weed frequency
<i>Dicanthium annulatum</i>	0.33	0.84	11	28.2
<i>Ehorbia prostrate</i>	8a	21a	77.66a	199.12a
<i>Convolvulus arvensis</i>	0	0	0	0
<i>Euphorbia hirta</i>	0.33	0.84	11	28.2
<i>Echinochloa crusgalli</i>	0	0	0	0
<i>Cyprus rotundus</i>	4.33	11.1	44.33	114
T4 Avg. Total Weed density= 27m²	Weed density	Relative weed density	Weed frequency	Relative weed frequency
<i>Dicanthium annulatum</i>	1	4	33.33	123.4
<i>Ehorbia prostrate</i>	2.33	9	33.33	123.4
<i>Convolvulus arvensis</i>	0	0	0	0
<i>Euphorbia hirta</i>	0	0	0	0
<i>Echinochloa crusgalli</i>	0.66	2.44	11	41
<i>Cyprus rotundus</i>	5a	19a	44.33a	164.18a
T5 Avg. Total Weed density= 77m²	Weed density	Relative weed density	Weed frequency	Relative weed frequency
<i>Dicanthium annulatum</i>	1.33	2	11	14.28

<i>Ehorbia prostrate</i>	19.66a	26a	89a	116a
<i>Convolvulus arvensis</i>	0	0	0	0
<i>Euphorbia hirta</i>	0	0	0	0
<i>Echinochloa crusgalli</i>	0	0	0	0
<i>Cyprus rotundus</i>	4.66	6.05	22	29

Weed frequency (%)

Table 2 showed the maximum weed frequency value for *E. prostrata* in all the treatments. The *D. annulatum* WF is the same is that of *C. Rotundus*, *C. arvensis* and *E. hirta* has been not found in T1 and T2. Table 3 indicating highest weed frequency value for *E. prostrata* except in the T4. *C. Rotundus* and *C. arvensis* were also finished by chemical control treatment. *D. annulatum* is vanished in the hand weeding treatment. Similarly from the Table 4 also showing the maximum value of *E. prostrata* i.e (89, 100, 89, 44.33 and 89). The second maximum value for the *D. annulatum* is (44.66, 33.33, and 44.33). Purple nutsedge shoot density in Bermuda grass was reduced by 66% with

single applications of halosulfuron at 72 g ha⁻¹ in Bermuda grass [12].

Relative weed frequency (%)

Table 2, 3 and 4 indicated the maximum relative weed frequency value for *E. prostrata* in all the treatments. The RWF of *D. annulatum* was same to *C. rotundus* in T1 treatment while it is differs in the rest treatments. The infestation of *E. prostrata* and *C. rotundus* is more severe followed by *D. annulatum*. Selective, post-emergence broadleaf herbicides can be used to control broadleaved weeds in lawns. Commonly available garden products contain one or more of the following active ingredients: MCPA, dicamba, DSMA, Bentazone, Bromoxynil, Mecoprop, 2,4-D, clopyralid [6].

Table 4. Individual weed density, relative weed density, weed frequency, relative weed frequency and treatment average total weed density m⁻² after 2week application

T1 Avg. Total Weed density= 43m ²	Weed density	Relative weed density	Weed frequency	Relative weed frequency
<i>Dicanthium annulatum</i>	0	0	0	0
<i>Ehorbia prostrate</i>	8.66a	20.13a	89a	207a
<i>Convolvulus arvensis</i>	0.33	0.76	11	26
<i>Euphorbia hirta</i>	0.33	0.76	11	26
<i>Echinochloa crusgalli</i>	0	0	0	0
<i>Cyprus rotundus</i>	5	12	77.66	181
T2 Avg. Total Weed density= 74m ²	Weed density	Relative weed density	Weed frequency	Relative weed frequency
<i>Dicanthium annulatum</i>	3	4.05	44.66	60.35
<i>Ehorbia prostrate</i>	12a	28a	100a	135.13a
<i>Convolvulus arvensis</i>	0.33	0.44	11	15
<i>Euphorbia hirta</i>	0	0	0	0
<i>Echinochloa crusgalli</i>	0	0	0	0
<i>Cyprus rotundus</i>	3	4.05	44.33	60
T3 Avg. Total Weed density= 29m ²	Weed density	Relative weed density	Weed frequency	Relative weed frequency
<i>Dicanthium annulatum</i>	1	3.44	33.33	115
<i>Ehorbia prostrate</i>	6.66a	23a	89a	307a
<i>Convolvulus arvensis</i>	0	0	0	0
<i>Euphorbia hirta</i>	0	0	0	0

<i>Echinochloa crusgalli</i>	0	0	0	0
<i>Cyprus rotundus</i>	2	6.89	44.33	153
T4 Avg. Total Weed density= 13m ²	Weed density	Relative weed density	Weed frequency	Relative weed frequency
<i>Dicanthium annulatum</i>	1	8	33.33	256.38
<i>Ehorbia prostrate</i>	2.33a	18a	44.33a	341a
<i>Convolvulus arvensis</i>	0	0	0	0
<i>Euphorbia hirta</i>	0	0	0	0
<i>Echinochloa crusgalli</i>	0.33	3	11	85
<i>Cyprus rotundus</i>	0.66	5.07	12	92.3
T5 Avg. Total Weed density= 104m ²	Weed density	Relative weed density	Weed frequency	Relative weed frequency
<i>Dicanthium annulatum</i>	2.66	3	44.33	43
<i>Ehorbia prostrate</i>	26.66a	26a	89a	86a
<i>Convolvulus arvensis</i>	0	0	0	0
<i>Euphorbia hirta</i>	0	0	0	0
<i>Echinochloa crusgalli</i>	0	0	0	0
<i>Cyprus rotundus</i>	5.33	5.12	33.33	32.04

Table 5. Secondary data showing importance value indices before application

T1 Avg. Total Weed density= 114m²	Relative weed density	Relative weed frequency	Importance value index
<i>Dicanthium annulatum</i>	2.28	38.88	41.16c
<i>Ehorbia prostrate</i>	23.68	78.07	101.75a
<i>Convolvulus arvensis</i>	0	0	0
<i>Euphorbia hirta</i>	0	0	0
<i>Echinochloa crusgalli</i>	0.28	9.64	9.92
<i>Cyprus rotundus</i>	7.3	38.88	46.18b
T2 Avg. Total Weed density= 109m²	Relative weed density	Relative weed frequency	Importance value index
<i>Dicanthium annulatum</i>	1.22	30.57	31.79c
<i>Ehorbia prostrate</i>	29	91.74	120.74a
<i>Convolvulus arvensis</i>	0	0	0
<i>Euphorbia hirta</i>	0	0	0
<i>Echinochloa crusgalli</i>	0.6	20.48	21.08
<i>Cyprus rotundus</i>	2.75	51.06	53.81b
T3Avg. Total Weed density= 216m²	Relative weed density	Relative weed frequency	Importance value index
<i>Dicanthium annulatum</i>	0.46	15.4	15.86c
<i>Ehorbia prostrate</i>	5.7	36.11	41.81a
<i>Convolvulus arvensis</i>	0	0	0
<i>Euphorbia hirta</i>	0.3	10.33	10.63
<i>Echinochloa crusgalli</i>	0	0	0
<i>Cyprus rotundus</i>	2.93	31	33.93b
T4 Avg. Total Weed density= 270m²	Relative weed density	Relative weed frequency	Importance value index
<i>Dicanthium annulatum</i>	0.61	12.22	12.83c
<i>Ehorbia prostrate</i>	5.8	37	42.8a
<i>Convolvulus arvensis</i>	0.37	4	4.37

<i>Euphorbia hirta</i>	0	0	0
<i>Echinochloa crusgalli</i>	0.37	4	4.37
<i>Cyprus rotundus</i>	1.97	16.41	18.38b
T5 Avg. Total Weed density= 282m ²	Relative weed density	Relative weed frequency	Importance value index
<i>Dicanthium annulatum</i>	0.35	3.9	4.35
<i>Ehorbia prostrate</i>	6.97	31.56	38.53a
<i>Convolvulus arvensis</i>	0.94	11.81	12.75c
<i>Euphorbia hirta</i>	0	0	0
<i>Echinochloa crusgalli</i>	0	0	0
<i>Cyprus rotundus</i>	2.95	19.73	22.68b

Importance value index

Table 5 shows individual weed of all treatments before application having importance value index of six infested weeds namely *D. annulatum*, *E. prostrata*, *C. arvensis*, *E. hirta*, *E. crusgalli* and *C. rotundu*. This table revealed that highest IVI of *E. prostrate* (101.75, 120.74, 41.81, 42.8 and 38.53) followed by *C. rotundus* (46.18, 53.81, 33.93, 18.38 and 22.68). The chemical effect on the *E. prostrate* is highly influenced as it is broad leaf in comparison to *C. rotundus*. *E. crusgalli* is not more observed than *D. annulatum*. Although *C. arvensis* is seen in the lawn but it is eliminate by the mowing like *E. hirta*. Both are broad leaf retard by chemical application is well. Overall view of the table showed that *E. prostrata* is important to be controlled as it is spreading type of growth habit not restricted its growth by the mowing. The hand weeding is also very difficult to uproot it because it cutted anywhere from which it is re-growth again. The chemical is the only control measure. On the other hand *D. annulatum* has not affected by the

chemicals as it is oily surface and narrow leaf, although some degree of senescence of the flower observed. Table 6 prevailed the highest IVI of *E. prostrata* (186.23, 150.4, 220.12 and 142) in the treatments (T1, T2, T3 and T5) respectively after 1 week application. In some experimental plot *E. crusgalli* is negligible because it is not a lawn weed, probably dispersed by wind or human shoes. In T4 *C. rotundus* is dominated over the *E. prostrata*. T4 is the chemical means of treatment. The question arise that why it is so? Because it is narrow leaf and oily surface. Also in this *C. arvensis* and *E. hirta* is zero means inhibited by the chemicals. From the Table 7 indicated highest value for *E. prostrata* in all the treatments. This weed was seemed in most of the plots. The data has been taken after 2 week application. In all the plots *E. crusgalli* was not showed. *D. annulatum* has formed rosette due to mowing as it is inhibiting its bolting stage. *C. rotundus* is also important in case of turf quality. A little yellowing of leaves by chemical application has been observed.

Table 6. Secondary data showing importance value indices after 1 week application

T1 Avg. Total Weed density= 47m ²	Relative weed density	Relative weed frequency	Importance value index
<i>Dicanthium annulatum</i>	0	0	0
<i>Ehorbia prostrate</i>	21	165.23	186.23a
<i>Convolvulus arvensis</i>	0.7	23.4	24.1
<i>Euphorbia hirta</i>	2.12	23.4	25.52c
<i>Echinochloa crusgalli</i>	0	0	0
<i>Cyprus rotundus</i>	9.48	142	151.48b

T2 Avg. Total Weed density= 76m ²	Relative weed density	Relative weed frequency	Importance value index
<i>Dicanthium annulatum</i>	3	73.23	76.23b
<i>Ehorbia prostrate</i>	18.4	132	150.4a
<i>Convolvulus arvensis</i>	0	0	0
<i>Euphorbia hirta</i>	0	0	0
<i>Echinochloa crusgalli</i>	0	0	0
<i>Cyprus rotundus</i>	3	29	32c
T3Avg. Total Weed density= 39m ²	Relative weed density	Relative weed frequency	Importance value index
<i>Dicanthium annulatum</i>	0.84	28.2	94.04c
<i>Ehorbia prostrate</i>	21	199.12	220.12a
<i>Convolvulus arvensis</i>	0	0	0
<i>Euphorbia hirta</i>	0.84	28.2	29.04
<i>Echinochloa crusgalli</i>	0	0	0
<i>Cyprus rotundus</i>	11.1	114	125.1b
T4 Avg. Total Weed density= 27m ²	Relative weed density	Relative weed frequency	Importance value index
<i>Dicanthium annulatum</i>	4	123.4	127.4c
<i>Ehorbia prostrate</i>	9	123.4	132.4b
<i>Convolvulus arvensis</i>	0	0	0
<i>Euphorbia hirta</i>	0	0	0
<i>Echinochloa crusgalli</i>	2.44	41	43.44
<i>Cyprus rotundus</i>	19	164.18	183.18a
T5 Avg. Total Weed density= 77m ²	Relative weed density	Relative weed frequency	Importance value index
<i>Dicanthium annulatum</i>	2	14.28	16.28c
<i>Ehorbia prostrate</i>	26	116	142a
<i>Convolvulus arvensis</i>	0	0	0
<i>Euphorbia hirta</i>	0	0	0
<i>Echinochloa crusgalli</i>	0	0	0
<i>Cyprus rotundus</i>	6.05	29	35.05b

Table 7. Secondary data showing importance value indices after 2week application

T1 Avg. Total Weed density= 43m ²	Relative weed density	Relative weed frequency	Importance value index
<i>Dicanthium annulatum</i>	0	0	0
<i>Ehorbia prostrate</i>	8.66	207	215.66a
<i>Convolvulus arvensis</i>	0.33	26	26.33c
<i>Euphorbia hirta</i>	0.33	26	26.33c
<i>Echinochloa crusgalli</i>	0	0	0
<i>Cyprus rotundus</i>	5	181	186b
T2 Avg. Total Weed density= 74m ²	Relative weed density	Relative weed frequency	Importance value index
<i>Dicanthium annulatum</i>	3	60.35	63.35b
<i>Ehorbia prostrate</i>	12	135.13	147.13a
<i>Convolvulus arvensis</i>	0.33	15	15.33
<i>Euphorbia hirta</i>	0	0	0

<i>Echinochloa crusgalli</i>	0	0	0
<i>Cyprus rotundus</i>	3	60	63c
T3Avg. Total Weed density= 29m ²	Relative weed density	Relative weed frequency	Importance value index
<i>Dicanthium annulatum</i>	1	115	116c
<i>Ehorbia prostrate</i>	6.66	307	313.66a
<i>Convolvulus arvensis</i>	0	0	0
<i>Euphorbia hirta</i>	0	0	0
<i>Echinochloa crusgalli</i>	0	0	0
<i>Cyprus rotundus</i>	2	153	155b
T4 Avg. Total Weed density= 13m ²	Relative weed density	Relative weed frequency	Importance value index
<i>Dicanthium annulatum</i>	1	256.38	257.38b
<i>Ehorbia prostrate</i>	2.33	341	343.33a
<i>Convolvulus arvensis</i>	0	0	0
<i>Euphorbia hirta</i>	0	0	0
<i>Echinochloa crusgalli</i>	0.33	85	85.33
<i>Cyprus rotundus</i>	0.66	92.3	92.46c
T5 Avg. Total Weed density= 104m ²	Relative weed density	Relative weed frequency	Importance value index
<i>Dicanthium annulatum</i>	2.66	43	45.66b
<i>Ehorbia prostrate</i>	26.66	86	112.66a
<i>Convolvulus arvensis</i>	0	0	0
<i>Euphorbia hirta</i>	0	0	0
<i>Echinochloa crusgalli</i>	0	0	0
<i>Cyprus rotundus</i>	5.33	32.04	37.37c

Conclusions and recommendations

Weed competition does have an impact on the performance of the turf grass crop. Overall, the herbicides treatments gave the best results in terms of quality turfgrass. The mowing treatments on the other hand closely followed the hand weeding which is a very good indicator for decreasing the annual weed control; therefore, selective herbicide can be included in the weed management strategies in future. Turf quality definitely was enhanced by the mowing treatments as compared to the weedy check. In the end, it can be declared that herbicide can give ultimate solution for suppressing weed population in highly infested area, if there is no other alternative control to boost up quality turf.

Authors' contributions

Design the experiment: Z Hussain & NU Amin, Data collection and analysis: L

Khan & K Shah, Technical help, data analysis and revision of the manuscript: Luqman & MI Khan

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