VOL. 7, NO. 7, JULY 2012 ISSN 1990-6145
ARPN Journal of Agricultural and Biological Science

www.arpnjournals.com

WEED CONTROL IN LAWNS IN GHANA

J. B. K. Asiedu[1], J. D. Owusu-Sekyere[2], P. Fiscian[1] and E. Afutu[1]
[1]Department of Crop Science, University of Cape Coast, Cape Coast, Ghana
[2]Department of Agricultural Engineering, University of Cape Coast, Cape Coast, Ghana
E-Mail: klartlands@yahoo.com

ABSTRACT

The research investigated the effect of various regimes of herbicide application and soil treatments on weed population dynamics in three widely used tropical turfgrass species; *Zoysia japonica* (Carpet grass), *Stenotaphrum secundatum* (St. Augustine's grass) and *Chrysopogon aciculatus* (Love grass). Turfgrasses were established on 5m × 1.5m plots by sprigging. Soil treatments included the following: a) plots overlaid with 3:1 topsoil/composted cow manure mix at a depth of 100 mm and b) plots with no topsoil or composted cow manure. Plots were then treated with post emergence herbicide (glyphosate) either once or twice. Non-treated plots were also included and served as the control. The research work was randomized and analyzed as unbalanced randomized complete block design. The results showed that the herbicide treatment did not reduce the quantity of germinating weeds on the plots and also there were no significant differences between the herbicide treatments. *Boerhavia diffusa* (Boerhavia) and *Cyperus rotundus* (Cyperus) were the predominant weed species. Love grass plots were invaded by higher quantity of weeds compared to the other two turfgrass species.

Keywords: weed, herbicide, pre-sowing treatment, turfgrass, sprigging.

INTRODUCTION

The establishment of a lawn as an outdoor green surface has become an important aspect of the landscape enhancing process in Ghana. Lawns provide open space for recreational activities and relaxation as well as a means to ameliorate heat and dust [1]. Their importance is especially appreciated on university campuses, where the establishment of lawns has become an integral part of the overall development and enhancement. The multiple benefits of the lawns are also appreciated by the private and commercial estate developers as well as by governmental estates.

A major challenge with lawn establishment in Ghana is the increased invasion by weed species taking into consideration that lawns in Ghana are mainly established by sprigging. It is a common practice that sprigs are planted on topsoil which has been mixed with composted manure. The top soil and the manure are imported to the site and spread over the area to be planted after the clearance of the existing vegetation and debris removal. The top soil is placed at a height of 150 mm to avoid dishing [2]. After sprigging the area is watered frequently until the lawn is established.

Weed control is usually performed after planting by hand. Hand-weeding might be repeated 2-3 times before the lawn is fully established. Extensive pre-planting treatment of the soil to control weeds is not common but occasionally hand-picking may be carried out before the sprigs are planted. After the establishment of the lawn weeds are controlled by mowing [3]. Despite the efforts to control weeds, most lawns in Ghana do not last more than three years as a result of weed pressure and invasion. Therefore the current research aimed to determine the effect of soil compost amendment and pre-planting herbicide treatments on the weed populations invading the three most commonly used turfgrass species of the Central Region of Ghana.

MATERIALS AND METHODS

The study was carried out at the Teaching and Research farm of the University of Cape Coast in the Central Region of Ghana from May to November 2008. The area has a bimodal rainfall pattern with a mean range of between 930-1200 mm. The major rainfall season starts from April - July with a short dry and cool period in August. The minor rainy season starts from September to mid November [4].

Site preparation and treatments

Three tropical lawn grasses *Chrysopogon aciculatus* (Love grass/beard grass), *Zoysia japonica* (Carpet grass/Japanese lawn grass), *Stenotaphrum secundatum* (St Augustine's grass), were selected and planted on 5 × 1.5 m plots. The plots were prepared by clearing the site of weeds, and the soil was cultivated to a depth of 150 mm [2]. The plots were overlaid with 100 mm deep topsoil mixed with composted cow manure (3:1 mix of topsoil with composted cow manure). The control plots received neither composted cow manure nor topsoil. The plots were fallowed for three weeks [5, 6] during which they were watered consistently to ensure active growth of weeds. At the end of the fallow period some plots were treated once or twice with glyphosate post-emergence herbicide (Round-up 360 g L^{-1} active ingredient, from Monsanto Europe NW), while the remaining plots received no herbicide treatment. The herbicide was applied between 6.30 and 7.30 am at the rate of 6.7 ml L^{-1}. The time between consecutive applications for the double herbicide application treatment was three to four weeks in order to achieve a complete re-growth of weeds after the first application.

ARPN Journal of Agricultural and Biological Science

www.arpnjournals.com

Ten days after the last herbicide treatment, the weeds were removed, the soil was cultivated and graded, and the three species of lawn grasses were sprigged. Plots without herbicide treatment were cleared of weeds by hand pulling during the actively growing stage before sprigging. Plot preparation and weed treatments were scheduled to ensure that all plots were sprigged on the same day.

Weeding sessions

Weeding was carefully performed by hand-pulling both shoot and root approximately three weeks after sprigging when the weeds were actively growing. Weeds picked were identified and dried in an oven at 105ºC for 48 h to a constant weight [7] before the final weight was taken. For each weeding session the dominant weed species were dried and weighed separately while the remaining weeds and occasional types were bulked together. In all there were 5 weeding sessions but for the purpose of this work the last three is considered.

Statistical design

The plots were laid in three blocks representing three replications. Each block had 18 plots; each plot represented a treatment. Treatments were randomly allocated to beds in a randomized complete block design consisting of two soil based treatments (manure and no manure treatment) and three regimens of herbicide treatment (no herbicide, once and twice herbicide applications). Weed type and quantity expressed as dry weight (g) were determined every three weeks during which weeds were separated into groups for each plot, identified, and their dry weight was determined. The dry weight was further used to calculate the quantity of weeds in kgm^{-2}.

RESULTS AND DISCUSSIONS

It was found that the predominant and most abundant weed species identified were *Boerhavia diffusa* (Boerhavia) and *Cyperus rotundus* (Cyperus). The less frequently occurring species included *Spedilia anthelmia*, *Cynodon dactylon* (Bermuda grass), *Centrosema pubescens* (Centro), *Ricinus communis* (Castor Oil plant), *Panicum maximum* (Guinea grass) and *Amaranthus spinosus* (Spiny Amaranthus). These were dried and weighed together as bulk weeds (Figure-1).

Love grass plots had the largest number of weeds based on dry weight measurements (0.29 kg m^{-2}) making up 42% of weeds produced from all treatment combinations and had more weeds than St Augustine's' plots (0.016 kg m^{-2}). St Augustine's had the lowest weed encroachment with a significantly lower quantity of cyperus although it produced the highest quantity of boerhavia weeds (Figure-2, Table-2). St Augustine's is considered to be better adapted to a wide range of soil and environmental conditions and therefore is an effective competitor and thus less prone to weed encroachment [8, 1]. The other two lawn grasses, especially Love grass, could be considered as marginally adapted due to the large infestations of weeds [1]. Weeds were reduced in quantity in consecutive weeding sessions in all three lawn grasses with St Augustine's grass showing the most consistent reduction.

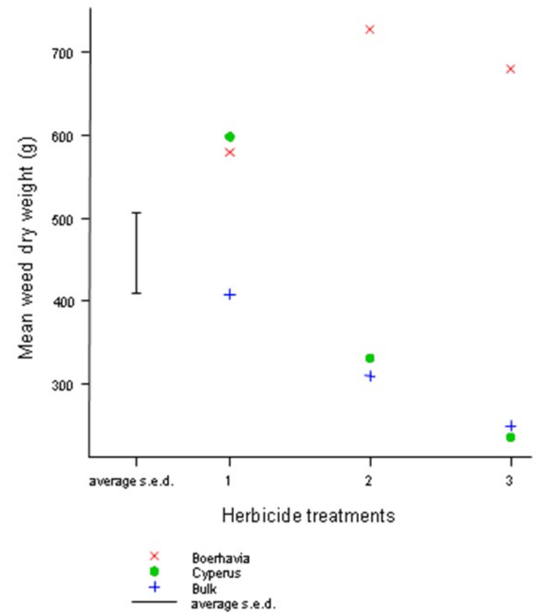

Figure-1. Mean weed dry weight (g) for three weed types as affected by Herbicide treatments, [none (1),

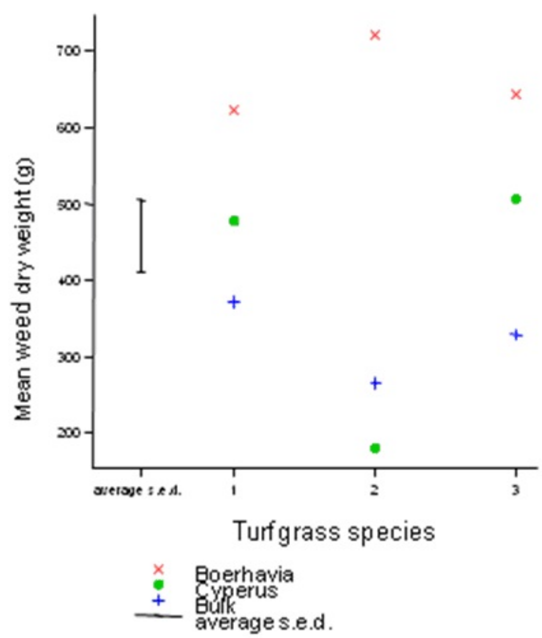

Figure-2. Mean weed dry weight (g) for three turfgrass species [Carpet (1), St Augustines (2), Love grass (3)]

The last weeding session produced the lowest quantity of weeds (Figure-3). Non-manure composted soil treated plots produced significantly less weeds (0.047kgm^{-2}) compared with manure composted plots (0.07kgm-^{2}) (Figure-4, Table-1). This is supported by the fact that composted cow manure produced by livestock fed with weed infested forage usually results in manure rich in weed seeds which when applied to the soil will result in increased weed problems [9]. Although one may agree with [10] that it is impossible to attain complete control of weeds in a lawn, the presence of perennial weeds is a bad indicator as they are more difficult to control [11]. [12] Explains that such weeds have a more aggressive growth habit and are able to dominate the plant community in which they are found, especially in situations where the lawn had suffered from poor management practices and environmental conditions [11]. Thus the dominance and persistence of the two perennial weeds (Boerhavia and Cyperus) despite the herbicide application may reflect underlying problems such as a basic soil problem [13] which may be associated with specific conditions not alleviated with herbicides [1, 11]. [11] Had observed that the presence of some weeds in large quantities in a plant community may be associated with certain physical and chemical properties of the soil of the area. These conditions may also be environmental, brought about by compaction, shading, poor irrigation, fertilization or mowing of the lawn.

No significant interaction was found between the soil treatments (composted cow manure and non-composted cow manure plots) and the herbicide treatments (no herbicide, once and twice herbicide treatments). In addition there were no significant differences between herbicide treatments and quantity of weeds produced on the plots. The number of the main weed types identified however differed significantly and also showed significant interaction with the turf grasses, soil type and weeding session (Table-2). This is in contrast with [14, 15] who observed that herbicide application in two applications was better than single application for effective weed control. However [6] suggested that if herbicide application is not effective it could be due to high weed density. The ineffectiveness of the herbicide could also be due to poor storage conditions which might have affected potency, more especially in a hot humid tropical environment.

Concluding, glyphosate herbicide was not able to effectively suppress the two main weeds (*Boerhavia diffusa* and *Cyperus rotundus*) found in the three lawn grasses despite the number of applications (once or twice). This is due to the fact that the performance of plots treated with the herbicide did not differ significantly from those that did not receive any herbicide treatment, including the control. The ineffectiveness of the herbicide could be attributable to some basic underlying problems of the soil or environmental factors like history of tillage in the area, shading, poor irrigation, fertilization or mowing of the lawn which may be enhancing the growth of the weeds.

The ineffectiveness could also be attributed to poor storage conditions which may have affected the potency of the herbicide given the rather hot and humid conditions of the tropics. The planting of lawn grasses which are better adapted to growth in the area like St Augustine's grass (*Stenotaphrum secundatum*) could be one way of reducing weed growth in lawns of Ghana.

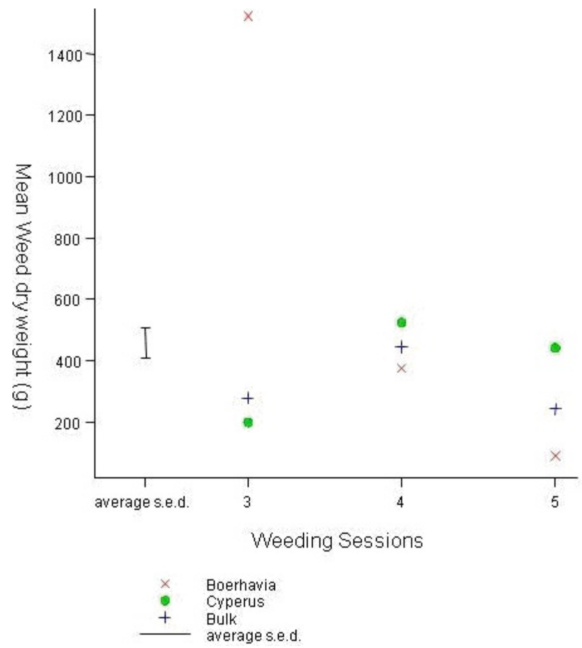

Figure-3. Mean weed dry weight for three weeding sessions.

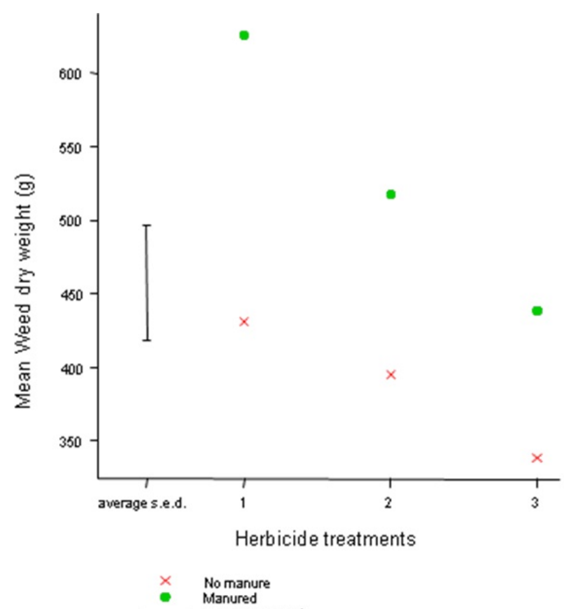

Figure-4. Mean weed dry weight (g) for two soil treatments as affected by Herbicide treatments, [none (1), once (2), twice (3)]

Table-1. Mean weed dry weight (g) as influenced by soil treatment, weeding sessions and weed type.

Soil treatment		Weeding sessions[a]		Weed type	
No Manure	388±32.02	1	667±39.21	Boerhavia	663 ±39.21
Manured	527±32.02	2	448±39.21	Cyperus	388±39.21
		3	258±39.21	Bulk	322±39.21
LSD	92		112.7		112.7
SED	46.8		57.3		57.3

a. Weeding sessions 1, 2 and 3

Table-2. Interactions between weed type, herbicide treatment, lawn grass type and weeding sessions on weed dry weight (g) basis.

Weed type	Herbicide treatment				Lawn grass type				Weeding sessions			
	None	Once	Twice	LSD	Zoysia	Stenotaphrum	Chrysopogon	LSD	1	2	3	LSD
Boerh	579.7 ±67.92	728.5 ±67.92	680.4 ±67.92	195.2	623.2 ±67.92	721.6 ±67.92	643.8 ±67.92	195.2	1523.0c ±67.92	375.9b ±67.92	89.7a ±67.92	195.2
Cyper	598.3b ±67.92	330.6a ±67.92	235.4a ±67.92		477.6b ±67.92	180.0a ±67.92	506.7b ±67.92		198.7a ±67.92	524.2b ±67.92	441.4b ±67.92	
Bulk	407.9a ±67.92	309.5a ±67.92	249.1a ±67.92		372.4 ±67.92	265.1 ±67.92	329.1 ±67.92		278.8 ±67.92	444.8 ±67.92	243.0 ±67.92	

REFERENCES

[1] Turgeon A.J. 1999. Turf grass management. Prentice-Hall, New Jersey, USA. pp. 234-235.

[2] Lovejoy D. and Partners ed. 1974. Spon's Landscape Handbook. Specifications and Pricing. E and F.N. Spon Ltd. London. pp. 90-91.

[3] McDaniel G.L. 1982. Ornamental Horticulture. Teston Publication Company. Virginia. 2nd Ed. p. 498.

[4] Opoku-Asiama Y., Mbofung G.A. and Amewowor D.H.A.K. 1998. Incidence of cassava root rots in the Central Region of Ghana. Journal of the Ghana Science Association. 1: 40-49.

[5] Bullock F.D. 2007. Lawn weeds management. Agriculture and natural resource management fact sheet. Tennessee State University. Cooperative extension programme. http://e-research.tnstate.edu/extension_factsheet/10 www.mdturfcouncil.org/edu/pdfs/TT-49%20Broadleaf%20Weed%20Control.pdf.

[6] McCloskey W. B (undated) with over-the-top Herbicide application. Cooperative Extension. University of Arizona. 4/01.

[7] Allen E.S., Grimshaw H.M., Parkinson J.A. and Quamby C. 1974. Preliminary and Analytical Tests. pp. 20-35. In: Ed. Allen, S.E. Chemical Analysis of Ecological Materials. Blackwell Scientific Publications. Oxford.

[8] Duble R.L. (undated). St Augustine's grass. Aggie Horticulture. Texas AgriLife Extension Service. Texas A and M System 2011. http://aggie-horticulture.tamu.edu/archives/parsons/turf/publications/staug.html.

[9] Renner K. 2009. Manure and Weed Seeds. Manure Sense. http://www.animalagteam.msu.edu/uploads/files/20/ weeds.pdf.

[10] Reicher Z. Bigelow C. Patton A. and Voigt T. 2006. Control of broadleaf weeds in home lawns. IL-INTW 31 AY-9-W. Turfgrass science. 2009. http://az.arizona.edu/crop/cotton/weeds/overtop/.pdf http://agry.purdue.edu/turf/pubs/ay-9.pdf.

[11] LeStrange M. and Reynolds C.A. 2008. Pest notes: Weed management in lawns. University of California Agriculture and Natural resources publication. www.ipm.ucdavis.edu/PMG/PESTNOTES/pn74113.html.

[12] Alam S.M. 1993. Allelopathic effects of weeds on the growth and development of wheat and rice under saline conditions. Higher Education Commission. Pakistan. 2011. http://eprints.hec.gov.pk/977/1/708.html.htm.

[13] Dernoeden P. H. 2005. Broadleaf weed control in established lawns. University of Maryland Technical update. TT-49, July.

[14] Mohassel M.H.R., Nassiri M. and Poorkazem E. 2001. The Effect of Glyphosate and herbicide combinations on pistachio garden weeds in Kerman. Proceedings of the 11th GREMPA Seminar on Pistachios and Almonds, 1-4th Sept. 1999. Turkey. 97-100.

[15] Anonymous (undated). Sustainable maintenance tips - Weed control. Managing weed succession. Natural Green. Halifax Regional Municipality 2009. http://www.halifax.ca/pesticides/documents/veg_succession.pdf.