SUSTAINABLE COMMERCIAL SOD PRODUCTION OF CYNODON DACTYLON (BERMUDA GRASS) IN GHANA: ASSESSING GROWTH, VISUAL, AND PHYSICAL QUALITY

Abstract

Despite health and environmental concerns associated with the use of artificial grass, there is a noticeable shift towards its usage.Using natural sod remains a more sustainable approach to maintain pitch quality in the country, though it is not commercially available. This study evaluated the growth, visual, and physical quality of Bermuda grass for commercial sod production using both seed and sprigs in Ghana. The experiment employed a 3x3 factorial randomized complete block design with three replications, considering fertilizer and base netting as factors. Fertilizer levels included chicken manure (10 tons/ha), Harvestmore® foliar fertilizer (460 kg/ha), and no fertilizer. Base netting consisted of window net, jute fibre mat, and no base netting. Parameters such as tiller length, clipping biomass, chlorophyll content index (CCI), color, smoothness, coverage, tensile strength, and handling quality were measured. For seeded sod, chicken manure without base netting resulted in the highest tiller length (27.62 cm), while the foliar fertilizer and no net interaction recorded 33.13 cm for sprigged sod. The combination of chicken manure with netting and without base netting exhibited the highest CCI, with values of 37.51 and 40.53 for seeded and sprigged sod, respectively.Treatments with fertilizer displayed thebest genetic color performance, and treatments with window netting also showed the best results for handling and tensile strength. Overall, the application of chicken manure and foliar fertilizer with window netting significantly improved the growth, visual appearance, and physical strength of both seeded and sprigged sod, meeting commercial standards.

Keywords: Sustainable sod production, Bermuda grass, Football pitches, Fertilizer and netting, visual quality.

1.0 Introduction

Sod, as defined by Turgeon(2006), refers to a mat-like piece of lawn comprising grass with soil attached to its roots, facilitating seamless growth when transplanted to another area. The method of turf establishment known as sodding involves using sod as the planting material. The advantage of this approach, as highlighted byGoatly(2016), lies in its ability to quickly utilize sod, minimizing material wastage, and allowing for year-round establishment using premium turfgrass varieties from producers. Sodding is particularly well-suited for total installation or repair of smaller areas, delivering instant results, especially in applications like football and soccer pitches(Yi, 2012).

For sports fields in Ghana, the utilization of artificial grass has surged in popularity over recent years. Artificial grass, while popular for its low maintenance and all-weather usability, is not without its harmful effects. Most artificial grass is made from petroleum-based materials, and its production and disposal contribute to the accumulation of non-biodegradable waste in landfills(Bari*et al*., 2021). Moreover, artificial grass can become excessively hot during sunny days, reaching temperatures much higher than natural grass, posing a risk of burns to individuals using the surface(Kamal, 2019). These mounting concerns over health risks and environmental impacts have prompted a growing interest in finding sustainable alternatives for maintaining pitch quality and green spaces. Among these alternatives, natural sod remains the most promising option owing to its eco-friendly attributes, ability to give instant results and contribution to biodiversity. Nonetheless, the availability of commercial-grade natural sod has been limited in many regions, including Ghana, thus necessitating the need for comprehensive research to explore viable solutions.

Over the past years, Bermuda grass (*Cynodon dactylon*) has gained popularity as one of the most extensively cultivated and utilized grass species globally, primarily owing to its remarkable tolerance for drought, resilience, and rapid growth(Shao*et al*., 2021). It finds frequent application as a turfgrass for lawns, golf courses, and it is the most common for sports fields in arid and semi-arid regions. Additionally, it serves essential purposes such as erosion control, livestock fodder, and land rehabilitation in these areas. Furthermore, Bermuda grass is readily available in Ghana both seed and sprigs making it ideal in the quest to explore the potential for commercial production to curb the over reliance on artificial turf for quality pitches.

Conventional sod production presents considerable expenses, particularly in terms of harvesting and installation, which surpass the actual production costs. It demands substantial capital investment, expansive fertile lands, specialized equipment with basic models costing around $50,000.00 and automated harvesters exceeding $250,000.00., and a significant market for product consumption(Trupin *et al.,* 2018; Kaiser & Ernst, 2019). The extended production period, spanning up to two years, presents financial and logistical obstacles for numerous nurseries and turfgrass growers in Ghana.Making it necessary explore more sustainable local options.

Sod producers rely on inorganic fertilizers, particularly through foliar application, to enhance soil quality(Zuza*et al.,* 2023). Research from the University of Michigan revealed that crops assimilate over 90% of nutrients from foliar-applied fertilizers and in sandy soil conditions, the effectiveness of foliar fertilizers is 20 times greater than soil application which soil conditions are not ideal. Chicken manure which is the commonest organic fertilizer in Ghana has gained popularity as a cost-effective and environmentally friendly alternative to inorganic fertilizers. Chicken manure is also rich in nitrogen and phosphorus, making it a valuable source of organic nutrients for improving soil productivity(Singh*et al*., 2020). An innovative approach to conventional sod production involves the use of base netting, which provides increased sod strength and shortens harvesting times. Studies conducted byBeard *et al*.(1980); Burns (1980); Carrow & Sills (1980)demonstrated that this technique can significantly reduce production periods, enabling turfgrasses to be harvested in as little as 2 to 3 weeks after planting, compared to the standard 2-year timeframe. This approach offers promising opportunities for more efficient sod production, benefiting the turfgrass industry and promoting quick and affordable sod production.

The escalating demand for quality turf in the context of sports fields, recreational areas, and urban landscaping necessitates an in-depth examination of growth, visual quality, and physical characteristics of Bermuda grass and while seed establishment is generally more cost-effective and easier to manage, sprig planting may offer the advantage of faster establishment and can potentially yield more vigorous sod. Understanding how Bermuda grass adapts to the factors such as base netting and fertilizer input is also critical for devising successful sod production strategies tailored to local conditions.The objectives of this research were, to assess the growth and visual quality response of Bermuda grass sod produced from seed and sprigs in a wooden frame system, to fertilizer and base netting; and secondly, to compare the post-harvest and cost benefit attributes of the resulting sod.

2.0 Methodology

2.1 Experimental location

The experiment was conducted at the College of Agriculture Education, Akenten Appiah Menka University of Skills Training and Entrepreneurial Development, Mampong Campus, from September 2020 to March 2021. The research site is in the savannah transitional zone of Ghana, with an altitude of 457 meters above sea level, and experiences annual rainfall between 1094 mm and 1200 mm, along with mean daily and monthly temperatures of 30.5°C and 32.0°C, respectively(Zakaria*et al.*, 2022).The soil at the site is classified as Ochrosol, formed from Voltaian sandstone, with a pH ranging from 6.0 to 6.5.

2.2 Experimental design, materials, and set-up

The experiment utilized a 3 x 3 factorial randomized complete block design with three replications, testing two fertilizer types and base netting materials. The experiment was conducted in a wooden frame system which served as plots for the sod. Each wooden frame had internal dimensions of 90cm x 60cm with 5cm depth. The wood was treated with 2% Dursban® 4E solution to prevent termite damage on the experimental field(Owusu*et al*., 2023).250 microns industrial black polythene sheet was used as a first layer to cover the entire experimental area and as a second layer to serve as a base and protection for the wooden frames. Polythene sheet was cut into 120cm x80cm pieces and placed in each frame.Soil was sieved to remove all debris and treated with 2% Acetastar solution and pasteurized.Two base netting materials were used in this study; rubber fiber net and jute mats. The rubber fiber net was purchased in rolls and cut into 60cm x 90cm pieces and the jute mats were purchased as sacks and cut into 60cm x 90cm mats for the experiments(Owusu*et al*., 2023).Sand was used to fill out the spaces between the wooden frames for the purpose of the experiment.Bermuda grass seeds were purchased from a seed store sown at 7grams/ plot. Sprigs were obtained from the Department of Horticulture KNUST, separated and cleaned for planting. Sprigs were cut to a length of 6inches and planted at 24 sprigs per plot. Decomposed chicken manure and Harvestmore® Foliar fertilizer were applied as fertilizers at 10 tons/ha and 4.5 kg/ha respectively.Watering was done twice daily, and weeding occurred every three weeks until the bermuda grass fully covered the plots.

2.3 Data collection

The study evaluated various parameters of sod harvested six months after planting. Data collected included tiller length, clipping yield (fresh and dry weight), chlorophyll content index (CCI), genetic color, smoothness, coverage, sod tensile strength, and handling quality. Tiller length was measured on nine random tillers per frame. Clipping fresh weight was determined by weighing freshly bagged clippings, while clipping dry weight was measured after drying the clippings in an oven. Chlorophyll content index (CCI) of the grass was estimated using an AtLeaf® Chlorophyll meter. Sod tensile strength was recorded using a modified Sod Tensile Strength (STS) measuring devices described in a research by(Owusu, *et al*., 2023). Sod handling quality (SHQ) was also rated on a scale of 1 to 5. Visual assessments were conducted by a trained panel of assessors following the National Turfgrass Evaluation Programme's (NTEP, USA) protocols.

2.4 Data analysis

For data analysis, the collected data underwent analysis of variance using Statistix® version 10. The Tukey's Honestly Significant Difference (HSD) test was employed to compare treatment means at a significance level of 5%.

3.0 Results and Discussion

3.1 Growth Parameters

3.1.2 Tillerlength

Upon considering interactive effects for sods produced from cynodon seeds, the pairing of the chicken manure with no base net led to the highest mean tiller length, measuring 27.62 cm (Table 1). This could be attributed to the higher levels of macronutrients (N, P, K) available in the Chicken manure treated sods that enhanced rapid growth and development hence taller tiller length. This interaction provided optimal soil conditions for growth and development, leading to increased tiller length.The combination of foliar treatment with no base netting resulted in the highest mean tiller length, measuring 33.12 cm for cynodon sprigged sods (Table 1). According to Talboys *et al*. (2020),proper foliar application is more efficient in terms of plant growth and development than soil fertilization due to the presence of stomata to directly absorb and utilize the foliar fertilizerthrough the leaves. Conversely, the interaction between the treatment without any fertilizer and jute mat (C-Jute) resulted in the lowest mean tiller length, measuring 8.16 cm and 21.28 cm for cynodon seeds and sprigs respectively (Table 1). This could be due to the presence of soil microorganisms acting on the jute mat during decompositionwhich take up nitrogen from the soil making it temporarily bio-inaccessible to the grass. This is a phenomenon called nitrogen lock, hence depriving them of available nutrients needed for growth.

3.1.2 Chlorophyll content index

The interaction between chicken manure and rubber fibre net recorded the highest (37.51) chlorophyll content index for seeded sod whereas the combination of Chicken manure and No net recorded the highest (40.53)chlorophyll content index for sprigged sod (Table 1). These interactions had a synergistic effect, where the nutrients from chicken manure combined with the support system provided by the base netting led to increased chlorophyll production owing to the fact that nitrogen, which is a major component of the chlorophyll compound is abundant in chicken manure. According to Voora *et al*. (2018)the higher availability of N, P, and K in the Chicken manure treated sods created a favorable environment for chlorophyll synthesis and plant growth. The quantity of chlorophyll per unit area is an indicator of the photosynthetic capacity of a plant and this is influenced by nutrient availability or environmental stress especially light (Komal *et al*., 2022).According to Oyedeji *et al*. `(2017), the improvement of chlorophyll in their study off Port Harcourt grass was logical since nitrogen is a structural element of chlorophyll and protein molecules, and thereby affects formation of chloroplasts and consequent accumulation of chlorophyll in them. Again, they indicated that a chlorophyll content index of less than 35 is an indication of poor plant health. The interaction between the treatment without no fertilizer and jute mat for cynodon seeds and sprigsrespectively resulted in a lower CCI values(Table 1). This suggests that the absence of fertilizer, combined with the presence of rubber fiber net, may have had a suppressive effect on chlorophyll production.

Table 1: Effect of fertilizer type and base netting on tiller length and chlorophyll content index

Treatment		**Tiller length**		**Chlorophyll content index**	
Fertilizer	**Base netting**	**Seed**	**Sprig**	**Seed**	**Sprig**
Chicken manure	Rubber fiber net	24.58^{ab}	25.45^{abc}	37.51^{a}	27.08^{b}
	Jute mat	22.07^{b}	29.00^{ab}c	32.30^{ab}	21.25^{b}
	No net	27.62^{a}	26.66^{ab}c	30.62^{ab}	40.53^{a}
Foliar fertilizer	Rubber fiber net	14.83^{c}	32.53^{ab}	28.11^{ab}	25.26^{b}
	Jute mat	8.28^{d}	22.32^{bc}	31.25^{ab}	26.71^{b}
	No net	13.23^{c}	33.12^{a}	27.58^{ab}	31.02^{ab}
No fertilizer	Rubber fiber net	14.12^{c}	27.66^{abc}	24.64^{b}	30.37^{ab}
	Jute mat	8.16^{d}	21.28^{c}	29.31^{ab}	19.72^{b}
	No net	13.27^{c}	28.11^{abc}	27.97^{ab}	24.68^{b}
HSD		***6.08***	***10.69***	***13.22***	***5.54***
CV (%)		***9.83***	***13.45***	***13.70***	***16.60***

3.1.3 Clipping fresh weight

For seeded Cynodon sod, the interaction between chicken manure and rubber fiber netting resulted in the highest significant mean clipping fresh weight of 491.67g(Figure 1). This again indicates a positive interaction where the combination of chicken manure as fertilizer and the use of rubber fiber netting created optimal growth conditions. Chicken manure contains higher levels of N, P and K and therefore provided adequate nutrients for vegetative growth whiles the base netting provided a strong system for the roots to grow and access the needed nutrients, resulting in a substantial increase in clipping fresh weight. On the other hand, the interaction between no fertilizer and jute mat netting recorded the lowest significant mean value of 27.33g(Figure 1). This suggests that the absence of fertilizer combined with the use of jute mat netting resulted in suboptimal growth conditions, leading to a significantly lower clipping fresh weight.

The interaction between chicken manure and no netting and the interaction between chicken manure and rubber fiber netting resulted in the highest significant mean weights of 189.67g and 184g, respectively for cynodon sprigged sod(Figure 1). This indicates that the combination of chicken manure as fertilizer and the absence or presence of netting created optimal growth conditions, resulting in increased clipping fresh weights. The application of chicken manure provided a rich supply of nutrients, while the presence or absence of netting influenced growth support and environmental factors, leading to improved growth and higher clipping fresh weights. On the other hand, the interaction between no fertilizer and jute mat netting recorded the lowest mean weight of 39.33g, suggesting that the absence of fertilizer combined with the limitations of jute base netting hindered growth and resulted in significantly lower clipping fresh weights. Similar trends were recorded by Oyedeji *et al*. `(2017) where they concludedthat increasing nitrogen levels led to increases in clipping biomas.

3.1.4 Clipping dry weight

The interaction between chicken manure and netting resulted in a significantly higher mean weight of 80.00gfor cynodon seeds(Figure2). This suggests that the combination of chicken manure as a fertilizer and the presence of netting created optimal conditions for vegetative growth, leading to increased clipping dry weight. On the other hand, the interaction between no fertilizer and jute treatment recorded the least mean weight of 7.33g(Figure2). This indicates that the absence of fertilizer, combined with the use of jute treatment, likely restricted nutrient availability and hindered growth, resulting in significantly lower clipping dry weights.

For sprigged cynodon sods, the interaction between chicken manure and rubber fiber netting resulted in a significantly higher mean weight of 45.67g(Figure2). This indicates that the combination of chicken manure as a fertilizer and the use of rubber fiber netting created optimal growth conditions, leading to increased clipping dry weights.On the other hand, the interaction between no fertilizer and jute mat resulted in the lowest mean weight of 16.33g(Figure2). This suggests that the absence of fertilizer, combined with the use of jute mat as netting, created suboptimal growth conditions, leading to significantly lower clipping dry weights

Generally, the nutrient-rich chicken manure combined with the supportive growth environment provided by the rubber netting resulted in a significantly higher mean clipping weight. Boateng *et al*. (2006) also observed an increase in biomass yield with the application of poultry manure (4-8 t/ha). These results could be attributed to the higher rate of macro and micronutrients available in the Chicken manure fertilizers (Boateng *et al*., 2006). Adekiya *et al*. (2020) further reported that the application of organic manures increased the soil organic matter (OM), N, P, K, Ca, and Mg which played a significant role in the increased clipping dry weight.

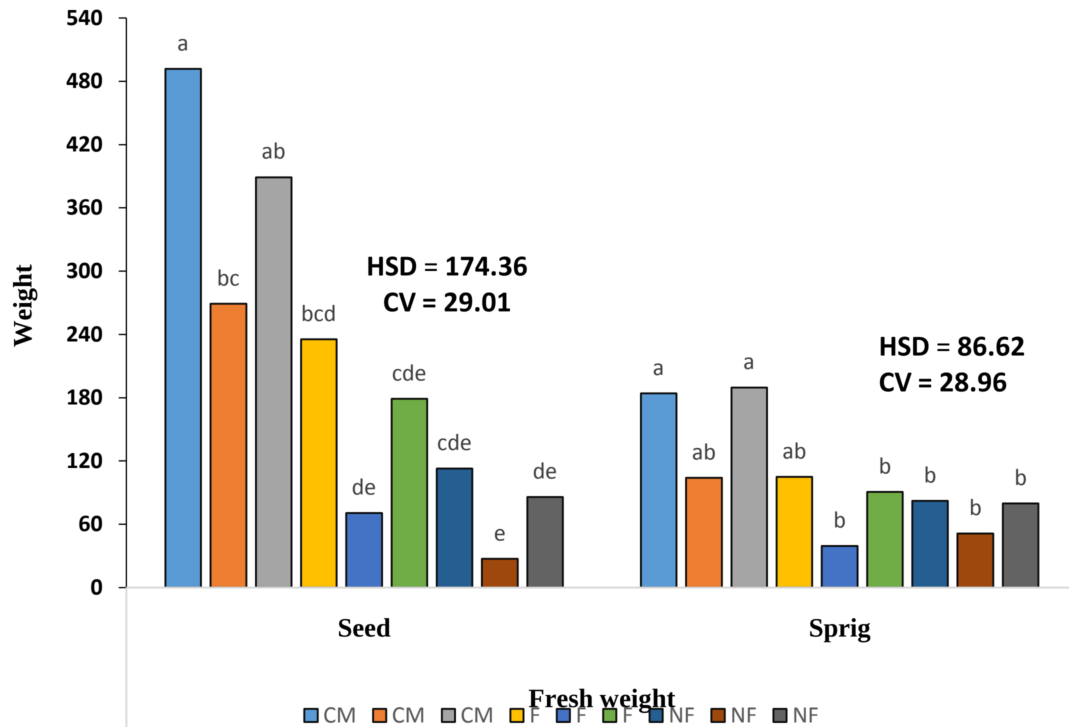

Figure 1: Effect of fertilizer type and base netting on clipping fresh weight

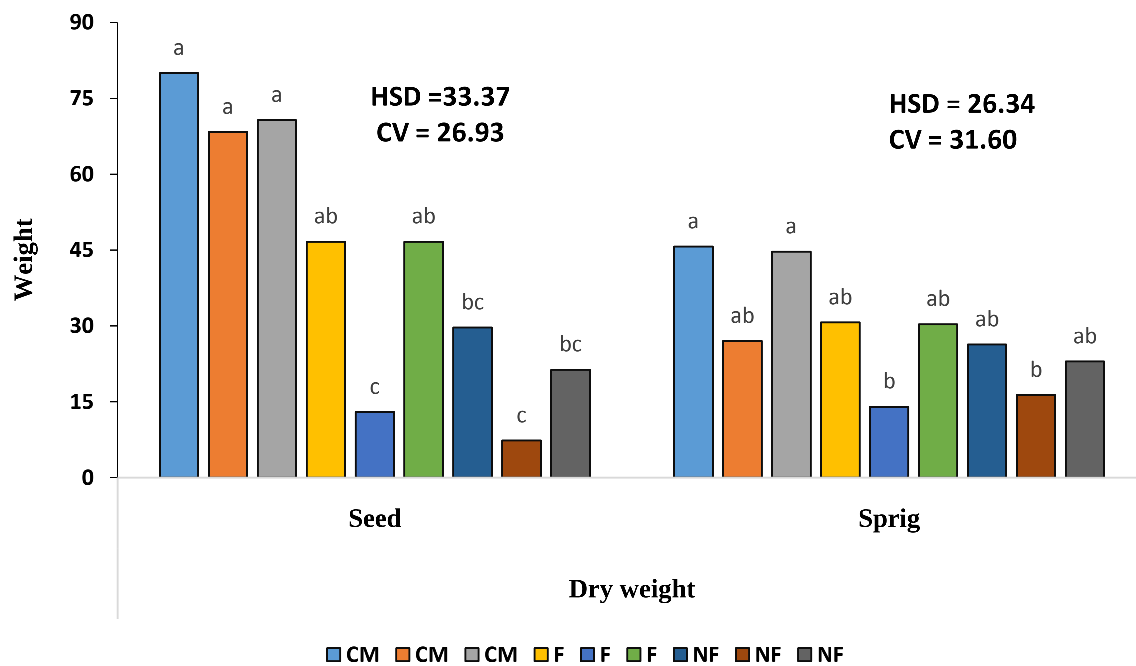

Figure 2: Effect of fertilizer type and base netting on clipping dry weight

3.2 Visual Quality Assessment

3.2.1 Smoothness

No significant difference was observed between the interactive effect of fertilizer and base netting on smoothness for sods produced from *C. dactylon* seeds and sprigs. This showed that treatment combinations could not adequately differentiate the perceived plant population per sod. In spite of the lack of significant differences these treatments obtained adequate ratings above 4.0 and are therefore commercially acceptable.

3.2.2 Genetic color

Color is one of the most important factors for assessing turfgrass quality, in this case, the green color of the grass. The intensity of greenness is also a measure of the health of the sod. In this study, color was analyzed using both visual methods as suggested by the National Turfgrass Evaluation Program of the USA, as well as the use of digital image processing with Turfanalyzer®. The combined effect of fertilizer and netting showed a significant ($p \leq 0.05$) difference among the treatment means for both seeds and sprigs. Interactively, chicken manure x no net recorded the highest color ratings for cynodon seeds, whereaschicken manure with rubber fiber net recorded the highest colour rating for sods produced from cynodon sprigs. However, all sods produced acceptable color quality ratings. Based on this all the treatments produced color quality values above 5.0 which is acceptable for commercial turf production according to NTEP protocols (Morris, 2002).

3.2.2 Coverage

Interactively, the combined effect of fertilizer and netting showed no significant ($p>0.05$) difference among the treatment means for coverage. However, Chicken manureand rubber fiber net treated sod had higher mean (8.17) coverage whilesno fertilizerand jute mat treated sod recording lowest mean (6.17) coverage for Cynodon seed sod (Table 2).whiles the treatments applied had no significant impact on coverage of sods produced from cynodon seeds all sods had adequate coverage ratings above 5.0. For sprigged *C. dactylon* sod however, the combined effect of fertilizer and netting showed significant ($p\leq 0.05$) differences among the treatment means. Chicken manure with rubber net treated sod had significantly ($p\leq 0.05$) higher mean coverage for spriggedCynodon sod whilefoliar and jute treated sod recorded the lowest mean coverage (Table 2). The nutrients in chicken manure, such as nitrogen, phosphorus, and potassium contributed to the improved coverage of the sod by providing the necessary resources for seed germination and growth allowing for quick spread of vegetative parts of the sod. Similarly, Lima *et al*. (2018) found that the application of nitrogen fertilizer increased the percentage of ground cover of Zoysia grass, and the application of 400 kg ha^{-1} N provided the fastest turfgrass closure. Based on the results all the treatments produced a coverage quality value above 55% which is acceptable for commercial turf production according to NTEP protocols. Commercially sod coverage below 50% might not be commercial acceptable and hence more time will be required to ensure adequate coverage(Doyle *et al*., 2021).

Table 2: Effect of fertilizer type and base netting on smoothness, genetic color and coverage

Treatment		**Smoothness**		**Genetic color**		**Coverage**	
Fertilizer	**Base netting**	**Seed**	**Sprig**	**Seed**	**Sprig**	**Seed**	**Sprig**
Chicken manure	Rubber fiber net	7.80^{a}	7.17^{a}	7.33^{ab}	8.27^{a}	8.17^{a}	8.70^{a}

	Jute mat	6.13^{a}	6.60^{a}	6.47^{ab}	6.47^{b}	6.70^{a}	6.60^{c}
	No net	7.80^{a}	7.60^{a}	8.03^{a}	6.93^{ab}	8.13^{a}	8.40^{ab}
Foliar fertilizer	Rubber fiber net	7.03^{a}	6.60^{a}	7.47^{ab}	6.93^{ab}	7.80^{a}	7.23^{bc}
	Jute mat	6.37^{a}	6.03^{a}	7.03^{ab}	6.50^{b}	7.03^{a}	6.23^{c}
	No net	6.57^{a}	6.23^{a}	6.70^{ab}	6.83^{ab}	7.47^{a}	6.90^{c}
No fertilizer	Rubber fiber net	6.47^{a}	6.70^{a}	5.80^{ab}	7.03^{ab}	6.80^{a}	7.27^{abc}
	Jute mat	6.03^{a}	6.50^{a}	5.47^{ab}	6.37^{b}	6.17^{a}	6.67^{c}
	No net	6.80^{a}	6.70^{a}	5.33^{b}	6.23^{b}	6.70^{a}	6.70^{c}
HSD		***2.87***	***0.76***	***2.57***	***1.59***	***2.83***	***1.45***
CV (%)		***14.77***	***9.40***	***13.35***	***8.01***	***13.47***	***6.96***

3.3 Post-HarvestQuality Assessment

3.3.1 Sod tensile strength

Sod tensile strength which is the force required to tear a sod into two pieces showed significant differences($p \leq 0.05$) treatment in means. The combination of foliar fertilizer and rubber fiber base netting resulted in significantly higher mean sod tensile strength values of 23.33kg ≈ (228.87 N) for seededCynodon sod.On the other hand, sod treated with the combination of no fertilizer and jute mat recorded the lowest mean sod tensile strength value 4.22kg ≈ (41.25 N) for seeded sod.The combination of chicken manure andrubber fiber net resulted in significantly higher mean 44kg ≈ (431.64 N) sod tensile strength values for spriggedCynodon sod.Sod treated with the combination of foliar fertilizer and Jute base netting recorded the lowest mean of 8.44kg ≈ (82.80 N) for sprigged sod.Chicken manure withrubber fiber net and Foliar fertilizer with rubber fiber net produced sods with higher tensile strength values under cynodon seeds and sprigs, and hence more acceptable for commercial turf production. The strong performance of rubber fibre netted sods for tensile strength could be due to the elastic helical structure of rubber fiber net that provides a good anchorage, physical support and protection to the roots of the sods,making it more difficult to break or split it.These finding are in agreement with the findings ofCarrow *et al*. (1981) who indicated the tensile strength of fescue sod with netting was 5 to 6 times higher compared to sod without netting. They further indicated thathandling tall fescue sod without netting was challenging, but when netting was present, its handling properties improved significantly, making it much easier to manage.

3.3.2 Sod handling quality

The foliar fertilizer combined with rubber fiber netting resulted in significantly ($p \leq 0.05$) higher mean sod handling quality for seeded sod compared to Chicken manure and rubber fiber net and jutemat treated sods, which recorded the statistically lower mean sod handling quality for seeded sod.On the other hand, the combination of chicken manure and rubber fiber netting resulted in significantly ($p \leq 0.05$) higher mean sod handling quality for sprigged sod, whereas sod treated with the no fertilizer and jute mat obtained the statistically lowest mean sod handling quality for sprigged sod. Chicken manure withrubber fiber net and Foliar fertilizer with rubber fiber netinteractions produced sods with higher handling quality ratings (above 3.0) under both seeded and sprigged Bermuda grass sods in the wooden frame system. These were acceptable for commercial turf production (Han, 2009). The good performance of netted sods for handling quality could still be attributed to the strong elastic helical structure of rubber fiber net that provides a good anchorage for the roots of the grass thereby forming a strong mat-like interwoven structure.

Table 3: Effect of fertilizer type and base netting on sod tensile strength and sod handling quality

Treatment	Sod tensile Strength	Sod handling quality

Fertilizer	Base netting	Seed	Sprig	Seed	Sprig
Chicken manure	Rubber fiber net	19.78^{ab}	44.00^{a}	3.00^{a}	4.33^{a}
	Jute mat	5.55^{bc}	13.55^{c}	1.00^{b}	1.50^{b}
	No net	4.00^{c}	13.34^{c}	1.00^{b}	1.50^{b}
Foliar fertilizer	Rubber fiber net	23.33^{a}	38.00^{ab}	3.67^{a}	4.00^{a}
	Jute mat	6.22^{bc}	8.44^{c}	1.17^{b}	1.17^{b}
	No net	4.22^{bc}	10.00^{c}	1.00^{b}	1.83^{b}
No fertilizer	Rubber fiber net	31.34^{a}	23.37^{bc}	3.50^{a}	4.00^{a}
	Jute mat	4.22^{bc}	10.67^{c}	1.17^{b}	1.33^{b}
	No net	6.67^{bc}	18.22^{c}	1.33^{b}	2.00^{b}
HSD		***15.70***	***17.12***	***0.90***	***0.93***
CV (%)		***46.14***	***29.49***	***16.57***	***13.33***

Conclusion

The results of this study conclusively reveal that the fertilizer type with or without base netting interactions enhanced the growth parameters (tiller length, chlorophyll content index and clipping biomass)in both seeded and sprigged *C. dactylon*sods in the wooden frame system. Both chicken manure and foliar fertilizer had no effect on smoothness of seeded and sprigged sods. Chicken manure and no net interaction and the interaction of chicken manure and rubber fiber net enhanced the genetic color for seeded and sprigged sods respectively. Chicken manure withrubber fiber base netting and foliar fertilizer with rubber fiber base netting interaction had no significant impact on coverage for both seeded and sprigged sods produced in the wooden frame system.Sod post harvest quality was improved by both the poultry manure and foliar fertilizers. The rubber fiber net sod had most acceptable handling and tensile strength after six months of production in the wooden frame system which were also commercially acceptable. It is therefore recommended that for improved growth, visual appearance, and physical strength of both seeded and sprigged sod, the application of chicken manure and foliar fertilizer with window netting should be used.

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