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Effect of different nutrition levels and seasons on nutrient uptake of lawn grass *Cynodon dactylon*

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ABSTRACT

Proper nutrient management improves the green colour and shoots density which is frequently used as a quality determination parameter in lawn. Fertilizers should be applied according to a lawn fertilization schedule. Too little fertilizer results in thin, sometimes yellowing turf. So an appropriate fertilizer should be used to maintain the deep colour, high density, uniformity, early green up and late fall colour retention. No systemic and scientific work has been identified with regard to nutrition of grass species. So far Assam is concerned not much research work has been conducted on standardization of optimum nutrient levels for proper growth and quality of *Cynodon dactylon*. Therefore field experiments were conducted with an objective to determine the effect of nutrient levels and seasons on nutrient uptake of lawn grass *C. dactylon* in both local and hybrid cultivar under Assam conditions. The seven treatments comprised of T0 - Control, T1 -Vermicompost 200g/m², T2- Vermicompost 200g/m² + 10:10:10gm/m2 (N:P:K), T3-Vermicompost 200g/m² +20:20:20gm/m2 (N:P:K), T4 - 40:40:40 gm/m² (N:P:K), T5 - 50:50:50 gm/m² (N:P:K) and T6 - 60:60:60 gm/m² (N:P:K). The results revealed that T6 exhibited highest amount and T0 contained lowest amount of N, P and K in the shoot tissue. The highest N contents of (5.055%), P (0.415%) and K (2.470%) were observed in the month of February'14. While the lowest N (2.567%) was in the month of July'13 and P (0.287%), K (1.267%) was observed in the month of August'13. Among the cultivars, the hybrid cultivar exhibited more N, P and K in all the months. More uptake of nutrient is required to maintain the quality parameters i.e. proper denseness, aesthetically pleasing colour etc.

KEY WORDS: *CYNODON DACTYLON*, LAWN GRASS, TURF

INTRODUCTION

The turf is an integral and significant part of the landscape and enhances its beauty when established properly, while a poor turf will detract from the overall appearance (Brede, 2000). Proper management of turf grass can lead to an aesthetically beautiful turf. *Cynodon dactylon* is one of the major turf grass grown for aesthetic as well as recreational purposes. Bermuda grass, *Cynodon spp.* is one of the most commonly grown turfgrass genera

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in the southern United States having excellent drought tolerance (Jeffrey *et al.* 2015).

The demand for the use of Bermuda grass as a turf grass is abundant and historical. Bermuda grass (*Cynodon dactylon*) is a warm-season turfgrass and is widely used on home lawns, golf courses, and sport fields. Bermuda grass is very wear resistant among the warm season turfgrasses and has an excellent recuperative capacity. *Cynodon dactylon* is further spread through its commercial use as forage and turf, being widely used in the Sonoran Desert region as a lawn grass, (Chambers and Hawkins, 2002, Turgeon, 2002).

Beyond practical purposes, the turf has helped to beautify many parks and landscapes, while also providing resilient playing fields for many sports. In addition to sports such as football and soccer, Bermudagrass is a desirable playing surface for numerous other activities, including polo fields and horse racing tracks, (Patton *et al.,* 2004 and Bloodhorse, 2005). Presently, its hybrids are used extensively as lawn grasses (Usher, 1974). It also has been used in soil stabilization projects for preventing soil erosion (Anderson, 1999). Hence, the present investigation on the nutrient uptake of Bermudagrass was undertaken with a view to find the optimum nutrient levels under which maximum nutrients are consumed to maintain a proper quality turf.

MATERIAL AND METHODS

The experiment was conducted in Department of Horticulture, Assam Agricultural university during 2013-2014 on Bermuda grass (both local and hybrid cultivars). The treatments included of T_0 - Control, T_1 -Vermicompost 200g/m², T_2- Vermicompost 200g/m² + 10:10:10gm/m² (N:P:K), T_3-Vermicompost 200g/m² +20:20:20gm/m² (N:P:K), T_4 - 40:40:40 gm/m² (N:P:K), T_5 - 50:50:50 gm/m² (N:P:K) and T_6 - 60:60:60 gm/m² (N:P:K).The experiment was laid out in a split plot design with 3 replication having a plot size of 1.5 square meter. The sources of nitrogen, phosphorus and potassium were urea, single super phosphate and muriate of potash, respectively. The different doses of vermicompost, nitrogen, phosphorus and potash applied with their treatment combinations. The remaining half nitrogen was splitted into three parts and applied during the month of August, November and February as foliar spray. The planting materials of local type required for the study were collected from the healthy mother plant from Horticultural orchard of Assam Agricultural University.

The hybrid cultivar was collected from Kaziranga Golf Resort. Sprigs of 3-4 nodes were planted at a spacing of 7cm x 7 cm by dibbling method. The plots were lightly irrigated just after planting. All the aftercare and intercultural operations like mowing, rolling, racking and weeding were performed at regular interval. Treatment wise above ground plants were collected at each month and were then chopped into small pieces and sun dried as well as oven dried at 60-65°C to a constant weight, powdered and stored in a sealed polythene bag for N, P and K analysis. The amount of nitrogen was expressed as percentage on dry weight basis. 0.5 mg of sample was taken in a digestion flask to which digestion mixture was added and the sample was digested with 25 ml of H_2SO_4 till a bluish liquid is formed. This digested solution was used for estimation of total nitrogen by Micro-Kjeldahl's method described by Humphries (1956). N was estimated as the amount of ammonia evolved during steam distillation of the digest.

For phosphorus estimation, plant samples were digested by the wet digestion method as described by Jackson (1973). 0.5 g of plant sample was taken in a 250 ml conical flask and 5 ml of conc. HNO_3 was added to it. After pre digestion with nitric acid, 10 ml of triacid mixture (HNO_3, H_2SO_4 and $HClO_4$ in the ratio of 10: 1: 4) was added to the conical flask and digested on hot plate at temperature between 200-250°C till yellow fumes were removed and about 2 ml of the solution was left. The solution was then used for determination of leaf phosphorus by adopting colorimetric method. The stock solution prepared for determination of leaf phosphorus was used for estimation of leaf potassium by using flame photometric method (Jackson, 1973).The experimental data obtained from various observations were analysed statistically by using Fisher's method of analysis of variance in spilt plot design as described by Panse and Sukhatme (1978).

RESULTS AND DISCUSSION

The significant increase of N content was detected with gradual increase in nutrient levels as evidenced from the table 1. Regarding month wise, N content was found in a decreasing trend from the month of April'13 to July'13. Thereafter it was increased from the month of August'13 onwards, followed by increased in the month of March'14. Among the treatments T_6 exhibited the highest and treatment T_0 exhibited the lowest amount of N in the shoot tissue. The highest N content (5.055%) was obtained in the month of February'14, followed by next higher level (5.046%) in the month of January'14 in treatment T_6 and they were at par, while in February'14 treatment T_0 recorded (3.461%) and in January (3.454%) of N in shoot. The lowest N content (2.567%) was observed in the month July'13, followed by August'13 (2.675 %) in Treatment T_0.

Cultivar effects on the per cent N content during the different months were found to be significantly different. Among the two cultivars C_2 exhibit more N content

Table 1: N content in shoot (%) at monthly interval

Cv. / Treatment	15th April'13			15th May'13			15th June'13			15th July'13			15th August'13			15th September'13		
	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean
T0	3.410	3.463	3.437	3.067	3.289	3.178	2.742	2.961	2.852	2.556	2.757	2.567	2.576	2.773	2.675	2.773	2.956	2.865
T1	3.367	3.553	3.460	3.262	3.479	3.371	2.878	3.052	2.965	2.662	2.878	2.770	2.694	2.963	2.829	2.859	3.069	2.964
T2	3.378	3.564	3.471	3.274	3.549	3.412	2.885	3.067	2.976	2.757	2.963	2.860	2.788	2.977	2.883	2.854	3.165	3.010
T3	3.519	3.650	3.585	3.385	3.561	3.473	2.884	3.090	2.987	2.851	2.972	2.912	2.865	2.989	2.927	2.973	3.173	3.073
T4	4.053	4.281	4.167	3.868	3.973	3.921	3.484	3.571	3.528	3.181	3.274	3.228	3.370	3.477	3.424	3.465	3.558	3.512
T5	4.449	4.664	4.557	4.178	4.348	4.263	3.669	3.776	3.723	3.372	3.459	3.416	3.575	3.775	3.675	3.755	3.961	3.858
T6	4.863	5.059	4.961	4.687	4.669	4.678	3.966	4.051	4.009	3.575	3.664	3.620	3.775	3.868	3.832	3.979	4.051	4.015
Mean	3.863	4.033		3.674	3.838		3.215	3.369		2.993	3.138		3.092	3.260		3.237	3.419	
		SEd(±)	CD(0.05)		SEd(±)	CD(0.05)		SEd(±)	CD(0.05)		SEd(±)	CD(0.05)		SEd(±)	CD(0.05)		SEd(±)	CD(0.05)
Effect of treatment(×10^{-2})		2.09	4.33		1.93	3.99		0.76	1.57		1.00	2.07		1.13	2.34		0.65	1.35
Effect of cultivar(×10^{-2})		0.84	3.62		0.05	2.20		0.19	0.08		0.58	2.50		0.55	2.37		0.20	0.88
Effect of interaction (×10^{-2})		2.96	6.12		2.73	5.65		1.07	2.22		1.42	2.94		1.60	3.31		0.92	1.91

Cv. / Treatment	15th October'13			15th November'13			15th December'13			15th January'14			15th February'14			15th March'14		
	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean
T0	2.846	3.053	2.950	2.871	3.084	2.978	3.069	3.266	3.168	3.290	3.454	3.372	3.359	3.562	3.461	3.277	3.445	3.361
T1	2.873	3.166	3.020	2.954	3.258	3.106	3.147	3.438	3.293	3.367	3.650	3.509	3.465	3.745	3.605	3.366	3.646	3.506
T2	2.963	3.275	3.119	3.161	3.468	3.315	3.253	3.547	3.400	3.446	3.558	3.502	3.656	3.773	3.715	3.381	3.640	3.311
T3	3.065	3.281	3.173	3.260	3.484	3.372	3.374	3.597	3.486	3.671	3.874	3.773	3.854	4.043	3.949	3.741	3.877	3.809
T4	3.572	3.687	3.630	3.659	3.765	3.712	4.058	4.158	4.108	4.379	4.444	4.412	4.464	4.569	4.517	4.266	4.366	4.316
T5	3.966	4.164	4.065	4.048	4.283	4.166	4.361	4.540	4.451	4.661	4.867	4.764	4.759	4.951	4.855	4.562	4.750	4.656
T6	4.061	4.267	4.164	4.161	4.367	4.264	4.593	4.741	4.667	4.851	5.046	4.949	4.948	5.161	5.055	4.862	5.047	4.955
Mean	3.335	3.556		3.445	3.673		3.694	3.898		3.952	4.128		4.072	4.258		3.922	4.110	
		SEd(±)	CD(0.05)		SEd(±)	CD(0.05)		SEd(±)	CD(0.05)		SEd(±)	CD(0.05)		SEd(±)	CD(0.05)		SEd(±)	CD(0.05)
Effect of treatment (×10^{-2})		1.20	2.48		1.16	2.40		1.48	3.07		1.02	2.11		1.43	2.96		1.08	2.23
Effect of cultivar(×10^{-2})		0.63	2.74		1.03	4.47		1.33	5.74		0.55	2.39		1.31	5.65		0.95	4.12
Effect of interaction(×10^{-2})		1.70	3.51		1.64	3.39		2.10	4.34		1.44	2.98		2.03	4.19		1.53	3.15

in all the months. The decreasing trend of N per cent was observed from the month of April'13 to July'13, followed by increased from the month of August'13 onwards.

This might be due to more availability of nutrients which reduced carbohydrates and thereby more nitrogen accumulation in shoots. Earlier Monore *et al.* (1967) and Singh *et al.* (1992) obtained more per cent nitrogen in shoot tissue with an increased level of nitrogen. Hence, the findings of the present investigations are in conformity with the findings of the above scientists. The highest per cent nitrogen content was obtained in the month February'14. This might be due to application of the splits of nitrogen in February'14 and less leaching as well as more mineralization of organic nitrogen. Powell *et al.* (1967) and Singh *et al.* (1992) have reported similar trend of findings in Kentucky bluegrass and *Cynodon dactylon* (L.) Persoon. The lowest per cent content was obtained in the month of July'13. This might be due to leaching loss and dilution effect due to increase in fresh weight of clipping. Singh *et al.* (1992) also reported decrease in per cent nitrogen of tissue during summer month (June and July). Hence, the results obtained in the present investigation are in conformity with the findings of the above workers. More nutrient uptake in spring months than the summer months was observed by Brink *et al.* (2005)

In cultivar C_1 highest N content (4.027%) was found in the month of February'14, followed by January'14 (3.952%). The lowest amount of N (2.993%) was found in the month of July'13 followed by August'13 (3.092%). Again in cultivar C_2 highest amount (4.258%) was recorded in the month of February'14, followed by January'14 (4.128%). The lowest amount was found in the month of July'13 (3.138%), followed by August'13 (3.260%).

Data on per cent P content in shoot in Table 2 revealed that there was a significant increase in P content with increased concentration of nutrients. Regarding month wise P content was found in a decreasing order from the month of April'13 to July'13. Thereafter it was increased from the month of August'13, followed by decreased in the month of March'14. Among the treatments T_6 exhibited highest and treatment T_0 exhibited lowest amount of P in the shoot tissue. The highest P content (0.415%) was obtained in treatment T_6 in the month of February'14, followed by next higher level (0.397%) in the month of January'14. The lowest P content (0.287%) was observed in the month August'13 in treatment T_0 followed by treatment T_1 (0.290 %). Among the two cultivars C_2 exhibit more P content in all the month's observation.

Beaty *et al.* (1960) reported similar findings of increasing trend of phosphorus content with a gradual increase in levels of nitrogen. Hillard *et al.* (1992), Rechigl (1992), Robinson and Ellers (1996), also reported that addition of phosphorus fertilizer increased phosphorus concentration in the Rye grass. This might be due to more vigorous growth of roots and shoots, which enhanced the uptake of phosphorus. Again in blue grass per cent phosphorus was increased by increasing potassium levels. The highest per cent phosphorus content of tissue (0.377%) was obtained in winter season particularly in February month in cultivar C_2, which might be due to mineralization of organic form of phosphate. The lowest per cent of phosphorus content was observed in summer season might be associated with dilution effect of highest weight of clipping. Powell *et al.* (1967) and Monore *et al.* (1967) also reported the similar trend of results in per cent phosphorus content. Hence, the results obtained in the present investigation are in conformity with the above workers.

In cultivar C_1 highest P content (0.370%) was found in the month of February'14, followed by January'14 (0.363%). The lowest amount of P (0.306%) was found in the month of August'13 followed by July'13 (0.306%). Again in cultivar C_2 highest amount (0.377%) was recorded in the month of February'14, followed by January'14 (0.368%). The lowest amount of P was found in the month of August'13 (0.306%), followed by July'13(0.306%).

Data on per cent K content in shoot revealed that there was a significant increase in K content with increased concentration of nutrients (Table 3). Regarding month wise K content was found in a decreasing order from the month of April'13 to July'13. Thereafter it was increased from August'13 onwards, followed by decreased in the month of March'14. Among the treatments T_6 exhibited highest and treatment T_0 exhibited lowest amount of K in the shoot tissue. The highest K content (2.470%) was obtained in the month of February'14, followed by next higher level (2.440%) in the month of January'14 in treatment T_6. The lowest K content in treatment T_0 (1.267%), followed by treatment T_1 (1.275 %) in the month August'13 and which were at par.

This is in line with Adane *et al* (2003) who reported that the nutrient of natural grass lands increases with increasing levels of N, P, K fertilizer application. Potassium concentration in tissues in response to potassium fertilization is nitrogen dependent. The lowest per cent potassium content was recorded in control which might de due to less growth of roots and shoots. Beaty *et al.* (1960) and Monore *et al.* (1967) in Kentucky blue grass and Webstar *et al.* (2005) in perennial rye grass also reported the increase in potassium content with an increase in levels of nitrogen. The highest per cent potassium content in both the cultivars was obtained in February. The higher per cent potassium content in winter season (February) might be due to more availability of potassium in soil. The lowest per cent potassium content in July'13 were recorded which might be due to

Table 2: P content in shoot (%) at monthly interval

Treatment \ Cv.	15th April'13			15th May'13			15th June'13			15th July'13			15th August'13			15th September'13		
	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean
T0	0.328	0.333	0.331	0.322	0.326	0.324	0.311	0.317	0.317	0.286	0.293	0.290	0.284	0.289	0.287	0.306	0.307	0.307
T1	0.334	0.338	0.336	0.327	0.331	0.329	0.316	0.325	0.321	0.295	0.297	0.296	0.287	0.293	0.290	0.314	0.316	0.315
T2	0.338	0.352	0.345	0.330	0.343	0.337	0.324	0.333	0.329	0.304	0.308	0.306	0.293	0.301	0.297	0.317	0.325	0.321
T3	0.345	0.356	0.351	0.342	0.345	0.344	0.335	0.338	0.337	0.315	0.319	0.317	0.303	0.313	0.308	0.336	0.343	0.340
T4	0.364	0.374	0.369	0.356	0.363	0.360	0.346	0.354	0.350	0.325	0.328	0.327	0.316	0.324	0.320	0.346	0.348	0.347
T5	0.375	0.379	0.377	0.366	0.373	0.370	0.353	0.361	0.357	0.334	0.337	0.336	0.328	0.332	0.330	0.352	0.357	0.355
T6	0.386	0.395	0.391	0.376	0.383	0.380	0.366	0.373	0.370	0.338	0.342	0.340	0.331	0.338	0.335	0.360	0.364	0.362
Mean	0.353	0.361		0.346	0.352		0.336	0.343		0.314	0.318		0.306	0.313		0.333	0.337	
		SEd(±)	CD(0.05)		SEd(±)	CD(0.05)		SEd(±)	CD(0.05)		SEd(±)	CD(0.05)		SEd(±)	CD(0.05)		SEd(±)	CD(0.05)
Effect of treatment (×10^{-3})		1.12	2.33		1.10	2.27		0.75	1.55		1.05	2.18		0.27	0.22		0.78	1.61
Effect of cultivar (×10^{-3})		0.57	2.48		0.33	1.43		0.50	2.15		0.19	0.82		0.04	0.56		1.29	5.57
Effect of interaction (×10^{-3})		1.15	3.29		1.55	3.21		1.06	2.20		1.49	3.08		0.38	0.79		1.10	2.28

Treatment \ Cv.	15th October'13			15th November'13			15th December'13			15th January'14			15th February'14			15th March'14		
	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean
T0	0.316	0.318	0.317	0.322	0.327	0.325	0.333	0.342	0.338	0.341	0.345	0.343	0.345	0.351	0.353	0.327	0.328	0.328
T1	0.319	0.320	0.320	0.325	0.328	0.327	0.334	0.336	0.335	0.349	0.351	0.350	0.344	0.354	0.349	0.328	0.332	0.330
T2	0.326	0.331	0.329	0.333	0.343	0.338	0.344	0.349	0.347	0.353	0.356	0.348	0.362	0.367	0.365	0.332	0.337	0.335
T3	0.342	0.347	0.345	0.341	0.353	0.347	0.355	0.363	0.359	0.362	0.371	0.367	0.363	0.376	0.370	0.344	0.344	0.344
T4	0.351	0.353	0.352	0.363	0.361	0.362	0.366	0.368	0.367	0.367	0.373	0.370	0.372	0.376	0.374	0.359	0.354	0.357
T5	0.363	0.364	0.364	0.372	0.375	0.374	0.375	0.384	0.380	0.381	0.387	0.384	0.384	0.394	0.389	0.363	0.364	0.364
T6	0.371	0.373	0.372	0.385	0.387	0.386	0.393	0.394	0.394	0.388	0.392	0.397	0.411	0.418	0.415	0.392	0.381	0.387
Mean	0.341	0.344		0.349	0.353		0.357	0.362		0.363	0.368		0.37	0.377		0.349	0.349	
		SEd(±)	CD(0.05)		SEd(±)	CD(0.05)		SEd(±)	CD(0.05)		SEd(±)	CD(0.05)		SEd(±)	CD(0.05)		SEd(±)	CD(0.05)
Effect of treatment (×10^{-3})		0.19	0.41		0.86	1.77		0.78	1.62		3.95	8.16		0.92	1.90		0.95	1.98
Effect of cultivar(×10^{-3})		0.60	2.56		0.57	2.48		0.85	3.69		1.85	7.99		0.16	0.71		0.36	1.54
Effect of interaction (×10^{-3})		0.28	0.58		0.12	2.51		1.11	2.29		5.59	11.55		1.30	2.69		1.35	2.80

Table 3: K content in shoot (%) at monthly interval

Cv. / Treatment	15th April'13			15th May'13			15th June'13			15th July'13			15th August'13			15th September'13		
	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean
T_0	1.451	1.565	1.508	1.373	1.453	1.413	1.203	1.365	1.284	1.204	1.356	1.280	1.192	1.342	1.267	1.352	1.462	1.407
T_1	1.465	1.572	1.519	1.394	1.493	1.444	1.311	1.467	1.389	1.214	1.363	1.289	1.198	1.352	1.275	1.425	1.527	1.476
T_2	1.553	1.683	1.618	1.474	1.527	1.501	1.375	1.527	1.451	1.224	1.476	1.350	1.208	1.398	1.303	1.675	1.703	1.689
T_3	1.775	1.824	1.800	1.702	1.763	1.733	1.621	1.627	1.624	1.512	1.527	1.520	1.413	1.428	1.421	1.725	1.834	1.780
T_4	1.924	1.927	1.926	1.874	1.897	1.886	1.825	1.851	1.884	1.713	1.843	1.778	1.602	1.723	1.663	1.852	1.947	1.886
T_5	1.962	1.997	1.980	1.914	1.993	1.954	1.927	1.986	2.061	1.814	1.985	1.900	1.708	1.823	1.766	1.926	1.994	1.960
T_6	1.984	2.014	1.999	1.976	2.094	2.035	1.983	2.064	2.105	1.917	2.026	1.972	1.802	1.942	1.872	1.984	2.027	2.006
Mean	1.731	1.797		1.672	1.701		1.606	1.660		1.514	1.654		1.446	1.573		1.706	1.785	
		SEd(±)	$CD_{(0.05)}$		SEd(±)	$CD_{(0.05)}$		SEd(±)	$CD_{(0.05)}$		SEd(±)	$CD_{(0.05)}$		SEd(±)	$CD_{(0.05)}$		SEd(±)	$CD_{(0.05)}$
Effect of treatment ($\times10^{-3}$)		1.08	2.22		0.74	1.52		0.76	1.58		0.81	1.68		0.53	0.82		0.64	1.32
Effect of cultivar ($\times10^{-3}$)		0.14	0.62		0.46	1.98		0.31	1.34		0.41	1.75		0.19	1.09		0.36	1.55
Effect of interaction($\times10^{-3}$)		1.52	3.14		1.04	2.15		1.08	2.24		1.15	2.37		0.75	1.55		0.91	1.87

Cv. / Treatment	15th October'13			15th November'13			15th December'13			15th January'14			15th February'14			15th March'14		
	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean
T_0	1.375	1.486	1.431	1.425	1.544	1.485	1.627	1.693	1.660	1.674	1.783	1.729	1.753	1.885	1.819	1.525	1.667	1.596
T_1	1.433	1.555	1.494	1.514	1.663	1.586	1.654	1.796	1.725	1.726	1.895	1.811	1.792	1.894	1.843	1.568	1.673	1.621
T_2	1.696	1.736	1.716	1.784	1.846	1.815	1.775	1.883	1.829	1.875	1.982	1.929	1.911	2.085	1.998	1.614	1.884	1.749
T_3	1.757	1.842	1.799	1.874	1.949	1.912	1.853	2.013	1.933	1.926	2.114	2.020	1.973	2.127	2.050	1.826	2.006	1.916
T_4	1.975	2.014	1.995	2.025	2.114	2.069	2.075	2.218	2.147	2.126	2.318	2.222	2.153	2.355	2.254	1.975	2.145	2.060
T_5	2.013	2.128	2.071	2.127	2.243	2.185	2.129	2.344	2.237	2.212	2.453	2.333	2.263	2.465	2.364	1.983	2.242	2.113
T_6	2.127	2.263	2.195	2.245	2.366	2.306	2.172	2.456	2.314	2.313	2.566	2.440	2.347	2.593	2.470	1.993	2.370	2.182
Mean	1.768	1.861		1.856	1.961		1.898	2.058		1.989	2.159		2.027	2.201		1.783	1.998	
		SEd(±)	$CD_{(0.05)}$		SEd(±)	$CD_{(0.05)}$		SEd(±)	$CD_{(0.05)}$		SEd(±)	$CD_{(0.05)}$		SEd(±)	$CD_{(0.05)}$		SEd(±)	$CD_{(0.05)}$
Effect of treatment($\times10^{-3}$)		1.77	3.65		1.25	2.58		0.77	1.58		0.78	1.63		0.80	1.65		0.14	3.04
Effect of cultivar ($\times10^{-3}$)		0.50	2.14		0.10	0.41		0.17	0.71		0.25	1.08		0.45	1.20		0.29	1.28
Effect of interaction($\times10^{-3}$)		2.50	5.16		1.77	3.64		1.08	2.24		1.11	2.30		1.13	2.33		2.08	4.31

less availability of potassium in soils that were entrapping with clay minerals. The increase in winter in per cent content of potassium and decrease in summer in the present investigation are in conformity with the findings of Beaty *et al.* (1960) and Powell *et al.* (1967).

Among the two cultivars C_2 exhibit more K content in all the months. In cultivar C_1 highest K content was (2.027%) found in the month of February'14, followed by January'14 (1.989%). The lowest amount of K (1.446%) was found in the month of August'13 followed by July'13 (1.514%). Again in cultivar C_2, highest amount (2.201%) was recorded in the month of February'14, followed by January'14 (2.159%). The lowest amount was found in the month of August'13 (1.573%), followed by July'13 (1.654%).

CONCLUSION

From the above findings it could be concluded that the nutrient uptake is different according to the different nutrition application and different season. Higher dose of nutrient supply increased the nutrient uptake in both the cultivars and the uptake was found to be more in the winter months.

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