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Macro, Micronutrients and Others Foliar Sprays Interactive Effect on Physiology of Sugarcane (*Saccharum officinarum*)

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Abstract:- Sugarcane (*Saccharum officinarum* L.) is the most important commercial crop cultivated worldwide in tropical and sub-tropical areas. It requires heavy amount of nutrients which must be applied through fertilizers to obtain high yield with sustainability. Micronutrient deficiency is one of the main factors significantly restricting yield of sugarcane crop. Although, micronutrients are required in very small amount but their constant supply to the crop has to be maintained. Because of adverse soil conditions such as high pH, lime or heavy texture, fixation and microbial infestation etc. crops root do not get proper micronutrient supply. Such hurdles can be avoided by adopting foliar application technique to increase the availability of macro as well as micronutrients. Foliar application is a wonderful technique to supply nutrients in the form of aqueous solution applied directly to the foliage in the form of sprays. This does not increase labour cost as pesticides are generally sprayed routinely. Keeping all these into account a pot (each containing 25kg in a polythene bag) experiment using Completely Randomized Design (CRD) under factorial design was performed during 2018-2019 (spring planting) at G.F. College, Agriculture Farm, Shahjahanpur, U.P. (India) to assess the effect of foliar sprays of following treatments T_1 = 2 % NPK + Fe, T_2 = 2 % NPK + Fe + Zn + more local brand, T_3 = 2 % NPK + Zn, T_4 = 2 % NPK, T_5 = 2 % NPK + Fe + Zn + Lime, T_6 2 % NPK + Fe + Zn, T_7 = water spray only (control) on ten sugarcane verities Cos 95255 (V_1), CoS 96268 (V_2), CoS 98231 (V_3), CoS 8436 (V_4), CoS 01235 (V_5), CoS 94257 (V_6), CoS 767 (V_7), CoS 97261 (V_8), CoS 97264 (V_9) and CoS 99269 (V_{10}) for leaf nutrient content (NPK), fresh weight cane (gm) and leaf amylase activity at harvest. The soil was sandy loam, pH 7.20, EC 0.62 mm hos/cm, organic carbon 0.3%, calcium carbonate = nil, low in available P and K. the micronutrients Zn (1.18 mg / kg), Fe (12.00 mg/kg), Mn (6.20 mg/kg) and Cu (1.52 mg / kg). Each treatment replicated thrice, single budded sett were used. Three foliar sprays of each treatment were done at an interval of 15 days in the month of May and June. Standard agronomic practices were managed and maintained according to crop need througout the investigation. A uniform basal dose of (150 Kg N, 60 Kg P and 80 kg / ha) fertilizer was applied to each pot (taking into account 1 ha = 2 million Kg soil). It was observed that fresh weight / cane was maximum (39.4 %) in 2 % NPK + Fe Zn + lime (T_5) followed by 2 % NPK + Fe (T_1) and 2 % NPK + Fe + Zn + local more brand (T_2) as compared to control sprayed with water only (T_7). The response of Cos 97261 (V8) was best in general. It was interesting to note that Cos 97261 (V8) also showed high leaf nutrient (NPK content) and better in leaf alpha–amylase activity. The impact of 2 % NPK + Fe + Zn + lime (T5) also correlated with high alpha amylase activity in leaves at harvest.

Keywords:- *Macro and Micronutrient Sprays, Lime, Leaf Nutrient Content (NPK) and Sugarcane.*

I. INTRODUCTION

Sugarcane is considered as the most economic cash crop for tropical and sub-tropical areas globally cultivated for sugar production. It is a very exhaustive crop and requires very large quantity of nutrients which must be applied through fertilizers to get maximum yield potential on sustainable basis (Shukla, 2010). The erux of plant nutrition problem in fact, exist in micronutrients deficiency which may decrease yield of sugarcane crop and creates disturbances in the physiological as well as metabolic process of the crop (Naga Madhuri et al., 2013). Monocropping, intensive cultivation use of high yielding varieties, use of micronutrients free fertilizers, unavailability of organic manure and several adverse edaphic factors may result in appearance of multi-micronutrient deficiencies in plants.

The requirement of micronutrient is very low, nonetheless their regular supply to the crop has to be ensured. Among the various micronutrients the deficiency nowadays of zinc and iron is widespread. Continuous replenishment of micronutrients from soil reserve due to enhanced food production resulted in the micronutrient deficiencies which brought sharp reduction in productivity, crop quality as well as animal and human health. Foliar application of nutrients is advantageous than soil application alone. According to Kinaci and Gulmezoglu (2007); Manasa

and Devaranavadegi (2015) there are various environmental factors which hinder the availability of nutrient to plant in the soil. Foliar application avoids these factors and increases the availability of macro and micronutrient due to rapid absorption by plants. The direct availability of nutrients through foliage increases the nutrient use efficiency. Various studies have confirmed the positive response of foliar application of micronutrients in different crops Manasa and Devaranavadegi (2015) (Maize), Hanwate et al., (2018) in (soyabean), Kinaci and Gulmezoglu (2007) in triticale. So, the present has been conducted to find the effect of foliar spray of macro ad micronutrients in sugarcane varieties on leaf nutrient content (NPK) fresh weight / cane and leaf amylase activity at harvest, lime foliar spray (Ming – Ming Duan et al., (2018) in rice, cow dung, Apeyuan et al. (2018) in roselle and (local more brand mixture) have also been included in the study due to their significant positive responses on other crops.

II. MATERIAL AND METHODS

A pot (each containing 25 kg soil in a large polythene bag) experiment using factorial randomized block design was conducted during 2018-2019 (Spring planting) at GF Agriculture Farm, Shahjahanpur 242001 U.P., India to study the "Effect of foliar spray of NPK and micronutrients together with lime local more brand mixture (50 % mud + 50 % cow dung) on leaf nutrient content (NPK), fresh weight / cane and leaf amylase activity at harvest of ten sugarcane varieties (CoS 95255 (V_1), CoS 96268 (V_2), CoS 98231 (V_3), CoS 8436 (V_4), CoS 01235 (V_5), CoS 94257 (V_6), CoS 767 (V_7), CoS 97261 (V_8), CoS 97264 (V_9) and CoS 99269 (V_{10}) in a sandy loam soil.

The soil was pH 7.20, EC 0.62 mm hos / cm, organic carbon 0.3%, calcium carbonate nil, low in available P and K. the micronutrients Zn (1.18 mg / Kg), Fe (12.00 mg / kg), Mn (6.20 mg / Kg) and Cu (1.52 mg / kg). Each treatment replicated thrice details as follows Table 1.

Single budded setts were used. Three sprays of each treatment were done at an interval of 15 days in the month of May and June. Standard Agronomic practices were managed and maintained according to crop need throughout the investigation. A uniform basal dose of (150 kg N, 60 kg P and 80 kg K/ha) fertilizer was applied to each pot (taking into account 1 ha = 2 million kg soil). The leaf nutrient content (NPK), fresh cane weight / cane and leaf amylase activity at harvest were recorded (Tables 2 to 6).

Fresh third leaf from each treatment collected and amylase activity was determined following the method of (Paleg, 1960). Later dried leaves powder of the harvested crop were used for leaf nutrient content (NPK). Estimation of nitrogen was carried out according to Lindner (1944). Phosphorus content was estimated by the method of Fiske and Subba Row (1925) and leaf potassium was estimated with the help of flame photometer.

III. RESULTS AND DISCUSSION

The effect of foliar spray of different treatments on fresh weight / cane, leaf nutrient content (NPK) and leaf alpha-amylase activity at harvest of sugarcane crop are discussed briefly.

All the parameters studied were significantly influenced by the foliar spray of $ZnSo_4$, $FeSo_4$, NPK (19:19:19), lime and local more brand mixture (Tables 2 to 6). However leaf nitrogen phosphorus and potassium content except varietal response were noted non-significant (Tables 3 to 5). The leaf amylase activity was found significant for treatment, varieties responses as well as their interaction (Table 6).

It was noted that fresh weight / cane was maximum (39.4 %) in 20 % NPK + Fe + Zn + lime (T_5) followed by 2 % NPK + Fe (T1) and 2 % NPK + Fe + Zn + more local brand mixture (T2) as compared to control (T_7) sprayed with water only.

The most effective (T_5) treatment (Table 2) for fresh weight / cane can be attributed to the best performance of these foliarly applied micronutrients, NPK as well as lime. Kumar et al., (2009), Shukla (2010) also documented the effectiveness of foliar spray of nitrogen sugarcane. Similarly zinc micronutrient is directly involved in the synthesis of tryptophan, a precursor of indole acetic acid, and the formation of enzymes that are responsible for cell growth and elongation (Mangrio et al., 2020). Normal growth of the plant can be affected due to non-availability of nutrients but foliar application avoids various edaphic hindrances and soil fixation and makes it available to the plant directly on time. Similarly significant increase in fresh cane weight increased with the foliar application of P and K too, as phosphorus is involved in synthesis of various biological molecules e.g. phospholipids, phosphoprotiens, nucleic acid, ATP, linked with various metabolic labyrinth (Devlin and Witham, 1983) and potassium a monovalent cation responsible for stomatal movements, sugar transport, protein synthesis, osmotic and nutrient regulation (Salisbury and Ross, 2005) cannot be overlocked. Rakkiyappan et al. (2002) reported the response of sugarcane to foliar application of ferrous sulphate (2 %) and found foliar application of Fe more effective than soil application for improving the iron content of leaf and it also have a direct impact on the sugarcane crop's growth (Forli et al., 2017). The results can be corroborated with the findings of Balaji et al., (2006) Singh et al., (2016) and Wang et al., (2009). In addition to above all, in treatment (T5) lime (1%) has also been included which might have additional additive effect on promotion of growth Ca is an essential plant nutrient. It is required for various structural roles in the cell wall and cell membranes, it is a counter cation for inorganic and organic anions in the vacuole and the cytosolic ca++ concentrations is an obligate intracellular messenger. Also for metabolic functions in Ca++ calmodulin pool (Salisbury and Ross, 2005, Ming-Ming Duan, 2018, Reddy and Reddy, 2004, Hepler, 2005).

Foliar spray of 2 % NPK + Fe + Zn + Local more brand mixture (50 % fresh cow dung + 50% mud) also proved better followed by T_5 treatment. It might be due to significant positive response of these organic additives together with NPK and micronutrients (T2) for fresh weight / cane (Table 2). The beneficial effects of cow dung foliar spray has also been reported by Apeyuan et al., (2018) in roselle.

Among the varieties CoS 97261 (V8) performed best and seems to be well adapted for the local area as compared to other varieties. CoS 96268 (V2) showed poorest response (Table 2). It was interesting to note that the response of CoS 97261 (V8) was superior with almost all parameters studied observed in all the treatments (Tables 2 to 6). It is quite understandable as species of a genus and even varieties of a species differ under the same environment condition in their utilization of inputs (Millikan, 1961; Evans and Sorger, 1966).

Starch hydrolysates are energy sources for plant growth and development regulate osmotic pressure and transmit signals in response to both biological and abiotic stresses (Yue et al., 2019; Dietze et al., 2014). The alpha amylase is an important enzyme that catalyzes the hydrolysis of plant starch. Hence higher leaf amylase activity in 2 % NPK + Fe + Zn + lime (T5) as well as in most responding variety Cos 97261 (V8), (table 6) seems to be significantly positively correlated with all other parameters standard (Tables 2 to 5).

IV. CONCLUSION

It is concluded that three foliar sprays of 2 % NPK (19:19:19) + 1 % $FeSo_4$ + 0.5% ZnSo4 + 1 % lime (T5) given at an interval of 15 days in the month of May and June to the Sugarcane crop (spring planting) significantly increased 39.4 % in fresh cane weight as compared to control sprayed with water only. This treatment is positively correlated with leaf alpha amylase activity at harvest. CoS 97261 (V8) performed best for almost all parameters studied.

Author Contributions

All the authors have equal contribution in preparing this manuscript.

Conflict of Interest

No conflict of interest is declared by authors

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REFERENCES

[1]. Apeyuan, K.D., A.O. Nwankiti and H.O.A. Oluma 2016. Comparative Effect of Foliar application of Cow Dung, Wood Ash and Benlate on the Disease Initiation and Development of Roselle (*Hibiscus sabdariffa* L.) Leaf Spot Disease Caused by *Coniella musaiensis* Var. Hibisci. in Makurdi, Central Nigeria, Journal of Geoscience and Environment Protection 04 (08): 26-32.

[2]. Balaji, T., S. Mani, A. Saravanan and T.N. Rao, 2006. Balanced fertilization for maximizing the yield of sugarcane in Periyar Vaigai command area. Indian Sugar; 56: 43-50.

[3]. Devlin, R.M. and F.H. Witham 1983. "Plant Physiology" W. Grant Press, Boston, Massachusetts.

[4]. Dietze, M.C., A. Sala, M.S. Carbone, C. Czimczik, J.A. Mantooth, A.D. Richardson and R. Vargas 2014. Nonstructural Coulson in wordy plants. Ann. Rev Plant Bul; 65: 667-87

[5]. Evans, H. and G.J. Jaund Sorger, 1966. Role of mineral elements with emphasis on the univalent cations. Ann. Rev. Plant Physiol. 17:47-76.

[6]. Fiske, C.S. Y. and Subba Row, 1925. The Colorimetric determination of phosphorus. J. Biol. Chem, 66; 375-400.

[7]. Forli, F., R. Otto, C.G. Vitti, I. Wylliam do vale and R.T. Miyake, 2017. Micronutrients application on cultivation of Sugarcane billets. African J. Agric. Res. 12: 790-794.

[8]. Hanwate, G.R., S.N. Giri and N.V. Yelvikar, 2018. Effect of Foliar Application of Micronutrients on Nutrient Uptake by Soybean Crop. Indian J. Pure Appl. Biosci. 6(5): 261-265.

[9]. Hepler, P.K. 2005. Calcium: A central. regulators of Plant growth and development. Plant Cell, 17: 2142-2155.

[10]. Kinaci, E. N. and Gulmezoglu, 2007. Grain yield and yield components of triticale upon application of different foliar fertilizers. Interciencia. 32(9): 624-628.

[11]. Kumar, V., R. Sharma, N.K. Gotal and J.P. Singh 2009. Recommended of use of potassium in sugarcane crop in Haryana. Indian Sugar. 58: 25-30.

[12]. Lindner, R.C. 1944. Rapid analytical method for some of the more common inorganic constituents of plant tissues. Plant Physiol, 19: 76-89.

[13]. Manasa, L.P. and S.B. Devaranavadegi, 2015. Effect of foliar application of micronutrients on growth, yield and nutrient uptake of maize. Karnataka J. Agric. Sci. 28 (4): 474-476.

[14]. Mangrio, N., M.N. Kandhro, A.A. Soomro, N. Mari and Z.H. Shah, 2020. Growth, yield and sucrose percent response of sugarcane to zinc and boron application. Sarhad J. Agric. 36 (2): 459- 469.

[15]. Millikan, C.R. 1961. Plant varuhus and spenes a relation to the occurrence of deficiencies and excess of certain nutrient elements J. Aush. Inst. Agne. Su., 26; 220

[16]. Ming-Meng Duan, Shuai Wang, Dao-You Huang, Qi-Hong Zhu, Shou-Long Liu, Quan Zhang, Han-Hua Zhu and Chao Xu. 2018. Effectiveness of simultaneous applications of lime and zinc/iron foliar sprays to minimize cadmium accumulation in rice, Ecotoxicol. Environ. Saf., 165: 510-515.
[17]. Naga Madhuri, K.V., N.V. Sarala, M. Hemanth Kumar, M. Subba Rao, M. and V. Giridhar, 2013. Influence of Micronutrients on Yield and Quality of Sugarcane. Sugar Tech. 15 (2): 187- 191. DOI: 10.1007/s12355-012-0196-3.
[18]. Palegs, L.G. 1960. Physiological effects of gibberellic acid on starch hydrolyzing enzymes of barley endosperm. Plant Physiol. 35: 902-906
[19]. Rakkiyappan, P., S. Thangavelu and R. Radhamani 2002. Effect of ferrous sulphate on sugarcane varieties grown in iron deficient soil. Sugar Tech. 4: 33-37.
[20]. Reddy, V.S. and S.N. Reddy 2004. Proteomics of calcium signaling components in plants. Phytochemistry, 65: 1745-1776.
[21]. Salisbury, F.B. and C.W. Ross, 2005. "Plant Physiology" (3rd Ed.) Wadsworth Pub. Co. USA. Belmont.
[22]. Shukla, S.K. 2010. Effect of some Agrochemicals sugar accumulation on and quality in early and late maturing sugarcane cultivars. Ph.D. Thesis (Awarded), M.J.P. Rohailkhand University), Bareilly.
[23]. Singh, A., R. Kumar and B.L. Sharma, 2016. Response of SPMC treated Zn and Cu on yield and quality of sugarcane. Agrica. 5(2): 107-110.
[24]. Wang, J.J., C.W. Kennedy, H.P. Viator, A.E. Arceneaux and A.J. Guidry 2009. Zinc fertilization of sugarcane in acid and calcareous soils. J. Am. Soc. Sugar Cane Technol. 25: 49-61.
[25]. Yue, C., H. Cao, H. Lin, J. Hu, Y. Ye, and J. Li, 2019. Expression patterns of alpha amylase and Beta-amylases genes provide insights into the molecular mechanisms underlying the responses of tea plants (*Camellia sinensis*) to stress and post-harvest treatments. Planta 250; 281-98.

Table 1. The experiment consists seven treatments.

T_1	2 % NPK + 1 % $FeSO_4$
T_2	2 % NPK + 1 % $FeSO_4$ +0.5 % $ZnSO_4$ + 5 % Local more brand*
T_3	2 % NPK + 0.5 % $ZnSO_4$
T_4	2 % NPK
T_5	2 % NPK + 1 % $FeSO_4$ + 0.5 % $ZnSO_4$ + 1% lime (Cao)
T_6	2 % NPK + 1 % $FeSO_4$ + 0.5 % $ZnSO_4$
T_7	Water spray (Only), control

***** Local more brand mixture:-:- It contains 50 % fresh mud + 50 % fresh cow dung (Gobar)

Table 3. Macro, micronutrients and other foliar sprays on leaf nitrogen (%) harvest in sugarcane (*Sachharum officinarum* L.) (Mean of three replicates)

Varieties								**Mean**
	(T_1) 2% NPK + Fe	**(T_2) 2% NPK + Fe + Zn + local**	**(T_3) 2% NPK + Fe + Zn**	**(T_4) 2% NPK**	**(T_5) 2% NPK + Fe + n**	**(T_6) 2% NPK + Fe + Zn**	**(T_7) Water spray only ()**	
CoS 95255	0.98	0.96	0.96	0.94	0.96	0.94	1.08	0.97
CoS 96268	0.96	0.98	0.96	0.94	0.92	0.96	1.08	0.97
CoS 98231	0.92	0.94	0.94	0.96	0.90	1.02	1.04	0.96
CoS 8436	0.94	0.96	0.90	0.94	0.96	0.92	1.06	0.95
CoS 01235	0.92	0.94	0.96	0.96	0.92	0.98	1.02	0.96
CoS 94257	0.90	0.96	0.90	0.94	0.98	0.98	1.12	0.97
CoS 767	0.90	0.88	0.91	0.94	0.96	0.96	1.14	0.96
CoS 97261	0.96	0.96	0.94	0.96	1.00	1.05	1.18	1.01
CoS 97264	0.90	0.90	0.96	0.94	0.92	0.90	1.16	0.95
CoS 99269	0.96	0.90	0.98	0.96	0.96	0.98	1.14	0.98
Mean	0.93	0.94	0.94	0.95	0.95	0.97	1.10	
		C.D. at 5%	F- Value					
	Treatments	0.026	NS					
	Varieties	0.032	*					
	Treatments X varieties	0.085	*					

	* = Significant NS = Non-significant							

Table 4. Macro, micronutrients and other foliar sprays on leaf phosphorus (%) harvest in sugarcane (*Sachharum officinarum* L.)
(Mean of three replicates)

Varieties								Mean
	(T_1) 2% NPK + Fe	**(T_2) 2% NPK + Fe + Zn + local**	**(T_3) 2% NPK + Fe + Zn**	**(T_4) 2% NPK**	**(T_5) 2% NPK + Fe + Zn**	**(T_6) 2% NPK + Fe + Zn**	**(T_7) Water spray only ()**	
CoS 95255	0.110	0.112	0.112	0.116	0.112	0.114	0.112	0.113
CoS 96268	0.108	0.110	0.110	0.112	0.114	0.112	0.112	0.111
CoS 98231	0.110	0.108	0.110	0.108	0.110	0.110	0.110	0.109
CoS 8436	0.112	0.120	0.116	0.114	0.112	0.116	0.112	0.115
CoS 01235	0.114	0.112	0.112	0.112	0.114	0.11	0.110	0.112
CoS 94257	0.114	0.116	0.120	0.120	0.116	0.118	0.114	0.117
CoS 767	0.118	0.118	0.118	0.116	0.114	0.114	0.112	0.113
CoS 97261	0.112	0.112	0.118	0.116	0.112	0.110	0.110	0.110
CoS 97264	0.118	0.116	0.112	0.114	0.118	0.120	0.112	0.113
CoS 99269	0.110	0.116	0.110	0.114	0.112	0.110	0.110	0.112
Mean	0.113	0.114	0.114	0.114	0.113	0.113	0.111	
		C.D. at 5%	F- Value					
	Treatments	0.0017	NS					
	Varieties	0.0021	*					
	Treatments X varieties	0.0055	NS					
	* = Significant NS = Non-significant							

Table 5. Macro, micronutrients and other foliar sprays on leaf potassium (%) harvest in sugarcane (*Sachharum officinarum* L.)
(Mean of three replicates)

Varieties								Mean
	(T_1) 2% NPK + Fe	**(T_2) 2% NPK + Fe + Zn + local**	**(T_3) 2% NPK + Fe + Zn**	**(T_4) 2% NPK**	**(T_5) 2% NPK + Fe + Zn**	**(T_6) 2% NPK + Fe + Zn**	**(T_7) Water spray only ()**	
CoS 95255	1.86	1.84	1.88	1.90	1.80	1.82	1.78	1.84
CoS 96268	1.82	1.80	1.82	1.80	1.90	1.78	1.80	1.82
CoS 98231	1.84	1.82	1.82	1.84	1.80	1.82	1.84	1.83
CoS 8436	1.80	1.78	1.82	1.82	1.80	1.80	1.86	1.81
CoS 01235	1.78	1.80	1.82	1.82	1.78	1.76	1.84	1.80
CoS 94257	2.00	1.92	2.04	2.00	1.96	1.98	2.05	1.99
CoS 767	1.98	2.00	1.98	1.96	1.94	1.90	1.98	1.96
CoS 97261	2.00	1.98	2.10	2.06	2.00	2.05	2.10	2.04
CoS 97264	1.98	1.96	1.94	1.92	1.96	2.08	2.05	1.98
CoS 99269	1.92	1.94	1.90	1.98	1.98	1.96	2.00	1.95
Mean	1.90	1.88	1.91	1.91	1.89	1.90	1.93	1.93

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		C.D. at 5%	F- Value					
	Treatments	0.068	NS					
	Varieties	0.081	*					
	Treatments X varieties	0.216	NS					
	* = Significant NS = Non-significant							

Table 6. Macro, micronutrients and other foliar sprays on leaf amylase activity (%) harvest in sugarcane (*Sachharum officinarum* L.)
(Mean of three replicates)

Varieties								**Mean**
	(T_1) 2% NPK + Fe	**(T_2) 2% NPK + Fe + Zn + local**	**(T_3) 2% NPK + Fe + Zn**	**(T_4) 2% NPK**	**(T_5) 2% NPK + Fe + Zn**	**(T_6) 2% NPK + Fe + Zn**	**(T_7) Water spray only ()**	
CoS 95255	14.90	15.40	15.20	17.20	14.10	18.20	20.60	16.51
CoS 96268	13.40	13.60	13.80	14.80	16.80	13.90	20.80	15.30
CoS 98231	15.10	14.70	14.80	14.70	13.90	13.90	18.60	15.10
CoS 8436	15.80	15.90	17.40	15.60	14.30	17.30	17.80	16.30
CoS 01235	16.90	15.90	14.90	14.90	16.40	14.10	16.60	15.67
CoS 94257	25.60	20.20	28.20	27.70	21.60	24.40	28.40	25.16
CoS 767	26.60	29.30	24.90	21.80	21.60	21.20	26.50	24.56
CoS 97261	22.40	22.60	24.40	22.20	21.60	20.90	26.90	23.00
CoS 97264	24.20	25.20	19.90	21.30	24.10	26.40	25.60	23.61
CoS 99269	19.90	24.10	18.90	21.80	20.20	18.90	24.34	21.16
Mean	19.48	19.69	19.24	19.20	18.46	18.92	22.61	
	Treatments	C.D. at 5%	F- Value					
	Varieties	0.90	*					
	Treatments X varieties	1.07	*					
	* = Significant NS = Non-significant	2.84	*					