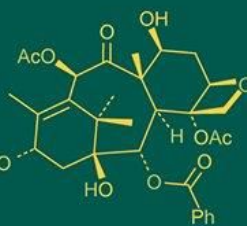
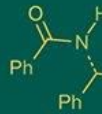
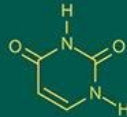


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Use of STCR technology and biofertilizer for sustainable soil fertility and sugarcane productivity

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Abstract

A field experiment was conducted at Vasantdada Sugar Institute; Pune (MH) to study the effect of STCR technology and bio fertilizer for sustainable soil fertility and sugarcane productivity with promising sugarcane variety VSI 08005 in pre-season. The experiment was comprised with the graded levels of NPK i.e. 0, 25, 50, 75 and 100% of the fertilizer dose worked out by STCR equation for achieving cane yield target 200 t ha⁻¹ and these treatments were integrated with bio-fertilizers under drip irrigation. The results showed that the judicious use of soil test crop response (STCR) technique and bio fertilizer were tested for achieving cane yield target of 200 t ha⁻¹ in plant cane crop in medium deep black soil. The pooled data of two plant cane crop showed that the highest and significant cane yield of 210.73 t ha⁻¹ (5.1% more than the targeted yield of 200 t ha⁻¹) was achieved by 100% STCR dose of NPK along with biofertilizers. However the target (203.5 t ha⁻¹) was achieved in 50% of STCR dose with judicious use of biofertilizers. The study recommended that fertilizer dose (N:P₂O₅:K₂O) can be reduced 50% of the total dose worked out by STCR targets yield equation technique along with the biofertilizer to achieve the yield of 200 t ha⁻¹ of sugarcane crop.

Keywords: STCR, sugarcane, soil test based equation

Introduction

Maharashtra is the second largest sugarcane growing state in India; however, average cane productivity is remained stagnant since last two decades. Sugarcane is an exhaustive crop and it requires huge amount of nutrients. Some practices gaining much popularity to enhance and maintain soil fertility and reduce the continuous and over dose use of inorganic fertilizer application which may adversely affect the physico-chemical properties of soil and thereby affect the crop performance.

Fertilizer is one of the most important agricultural inputs for increasing the crop production. Soil testing is now accepted as a procedure for the recommendation of fertilizer doses for various crops in India. But soil testing would become a useful tool only when it is based on intimate knowledge of soil-crop-variety-fertilizer-climate management interaction for a given situation (Kanwar, 1971) [6]. In this regard targeted yield approach has been found to be beneficial which recommends balanced fertilization considering available nutrient status in the soil and the crop needs. Targeted yield approach was first developed by Truog (1960) [8] and Ramamoorthy *et al.*, (1967) [7] established theoretical basis and experimental technique suit to Indian conditions. Excessive and indiscriminate use of inorganic fertilizers creates imbalance of nutrition causing decline in productivity and simultaneously increase the cost of production per ton of cane. Application of adequate inorganic fertilizers supplemented with organic manures and bio fertilizers on soil test basis will certainly be helpful for increasing productivity of sugarcane with better soil health (Jyothi *et al.*, 2020) [5].

The effective fertilizer recommendation should consider crop needs and nutrients already available in the soil. Among various methods of fertilizer recommendation such as general recommended dose (GRD), soil test based recommendation, critical value approach, *etc.*, the soil test crop response (STCR) approach for target yield is unique in indicating both soil test based fertilizer dose and the level of yield that can be achieved with good agronomic practices (Jyothi *et al.*, 2020) [5]. The specific target yield equation based on soil fertility besides ensuring sustainable crop production also steers the farmers towards economic use of costly fertilizer inputs depending on their financial status and market price of the crop under consideration (Bera *et al.*, 2006) [1]

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Targeted yield approach stricken a balance between fertilizing the crop and fertilizing the soil. The use of high analysis fertilizers and restricted recycling of organics have resulted in low yields. Farmers are applying inadequate and imbalanced fertilizers so there is need to use soil test crop response approach. Keeping this in view the present investigation was conducted at Vasantdada Sugar Institute, Pune to study the effect of STCR recommendation technology and bio fertilizer for sustainable soil fertility and sugarcane productivity with promising sugarcane variety VSI 08005 in preseason.

Materials and Methods

A field experiment was conducted during pre-season at Vasantdada Sugar Institute research farm during 2016-17 to 2018-19. The soil under experimental plot was clayey in texture, moderate in available Nitrogen, high in available phosphorus and moderately high in available potassium and organic carbon. Composite soil sample was drawn from the experimental site at 0-15 cm depth prior to laying out of experiment. Experiment was designed in Randomized block design with eleven treatments. The experiment was comprised with the graded levels of NPK i.e. 0, 25, 50, 75 and 100% of the fertilizer dose worked out by STCR equation for achieving cane yield target 200 t/ha and these treatments were integrated with bio-fertilizers under drip irrigation. The field observations of biometric, growth and yield parameters were taken at different stages of the crop and at harvest. Sugarcane juice quality brix and pol percentage analyzed by using standard methods. The soil chemical analysis was done by methods of Jackson, (1973) [4]. The data collected was statistically analyzed as per the procedures given by Gomez and Gomez (1978) [3].

Table 1: STCR equation for Plant crop

Essential Element	Fertilizer dose (Kg / ha)
Nitrogen (Kg / ha)	$(3.73 \times T) - (1.14 \times SN) - 3.09 \text{ FYM}$
Phosphorus (Kg / ha)	$(1.49 \times T) - (2.54 \times SP) - 2.24 \text{ FYM}$
Potassium (kg / ha)	$(3.15 \times T) - (0.63 \times SK) - 1.16 \text{ FYM}$

Table 2: Fertilizer dose applied for Plant cane on the basis of STCR equation

RDF (Kg/ha)	Plant cane I			Plant cane II		
	N	P	K	N	P	K
100%	483	155	117	331	263	155
75%	362	116	88	248	107	116
50%	242	78	59	166	132	78
25%	121	39	29	83	65	39
Initial soil analysis	274	28	844	407	27	784

(Source: Krishi Diary, MPKV, Rahuri)

Result

The field experiments were conducted on soil test crop response integrated technology with biofertilizers for achieving cane yield target of 200 t/ha in pre-season plant cane crop. The pooled data of two plant cane with respect to cane yield, sugar yield, growth parameters, juice quality and economics are presented in Table 1.

Cane Yield

The present investigation undertaken to study the use of STCR technology and biofertilizer for sustainable soil fertility and sugarcane productivity for pre-season sugarcane with targeted yield. The pooled cane yield data of two plant

cane was significantly influenced by the graded levels with and without biofertilizers. The maximum cane yield in plant cane (210.73 t/ha) was observed in T₅ treatment of 100% GRDN through fertigation integrated with bio fertilizer followed by T₇ (204.77 t/ha) 75% GRDN through fertigation with bio fertilizer and T₉ (203.47 t/ha) 50% GRDN through fertigation with bio fertilizer which was statistically significant over the control where 70% NPK fertilizers were applied through fertigation (178.64 t/ha). The cane yield was found statistically significant and on par with biofertilizers. The treatment with 100% (191.36 t/ha), 75% (191.11 t/ha) and 50% (190.52 t/ha) NPK fertilizer applied through drip irrigation without biofertilizers showed more or less similar results which are significantly less than the treatments with bio fertilizers. The increase in yield due to application of fertilizers based on different approaches was attributed to the increase in growth and yield attributes as a consequent of improved nutrient supply and efficiency of applied fertilizers in soil. Same results were recorded by Ghube *et al.*, 2017 [2].

Commercial Cane Sugar Yield

The data of CCS yield was showed in table no.1. In two year pooled data of plant cane, maximum CCS yield was recorded in treatment T₅ (29.79 t/ha) of 100% GRDN through fertigation integrated with bio fertilizer followed by treatment T₉ (29.56 t/ha) 50% GRDN through fertigation integrated with bio fertilizer and T₇ (28.72 t/ha) 75% GRDN integrated with bio fertilizer which was statistically significant over control (24.75 t/ha). Same result was recorded by Jyothi *et al.*, 2020 [5].

Plant population

Maximum plant population was obtained in treatment T₅ (84.01 thousand/ha) where 100% GRDN through fertigation integrated with bio fertilizer followed by T₇ (83.53 thousand/ha) 75% GRDN integrated with bio fertilizer and T₉ (82.71 thousand/ha) 50% GRDN through fertigation integrated with bio fertilizer which was statistically significant over control 78.47 thousand/ha 70% NPK fertilizers were applied through fertigation. Same results were recorded by Ghube *et al.*, 2017 [2].

Growth parameters

In pooled data of plant cane maximum cane girth was obtained in 10.36 cm in treatment T₇ and T₉ which was significant over control (10.07cm). The maximum milliable cane height was obtained in T₅ treatment 303.28cm followed by T₇ (301.78 cm) and T₉ (301.22 cm) treatment which was significantly superior over control (266.45 cm). Same result was recorded by Jyothi *et al.*, 2020 [5].

Juice quality

The juice quality parameters with respect to brix, pol, purity and CCS% are presented in Table 1 indicated that juice quality was not affected by application of 100%, 75%, 50% and 25% NPK fertilizer dose applied through fertigation with and without bio fertilizers.

Economic evaluation

In plant cane crop the benefit cost ratio also found more or less same in 25% 50%, 75% and 100% NPK levels under fertigation compared to 70% NPK through fertigation.

Table 1: Effect of STCR technology and biofertilizers on Cane yield and yield contributing parameter

Treatment	Cane Yield (t/ha)	CCS yield (t/ha)	B:C ratio	No. of milliable canes ('000' /ha)	Milliable cane height (cm)	Internode	Girth (cm)	CCS %
T ₁ - Absolute control	154.7	22.26	3.94	73.94	248.78	22.83	9.90	14.37
T ₂ - Soil application of 100% GRDF as per STCR (200 t/ha)	167.8	24.39	3.58	77.34	265.71	23.17	9.95	14.55
T ₃ - 70% GRDN through fertigation (control)	178.6	24.75	2.76	78.47	266.45	22.67	10.0	13.83
T ₄ - Fertigation of 100% GRDN as per STCR for 200 t/ha	191.3	27.20	2.87	80.64	285.22	23.39	10.2	14.39
T ₅ - Fertigation of 100% GRDN as per STCR + biofertilizer for 200 t/ha	210.7	29.79	3.15	84.01	303.28	23.06	10.3	14.13
T ₆ - Fertigation of 75% GRDN as per STCR for 200 t/ha	191.1	25.76	3.00	81.75	299.15	23.84	10.2	13.48
T ₇ - Fertigation of 75% GRDN as per STC + biofertilizer for 200 t/ha	204.7	28.72	3.20	83.53	301.78	22.89	10.3	14.02
T ₈ - Fertigation of 50% GRDN as per STCR for 200 t/ha	190.5	26.85	3.13	79.03	279.89	23.67	10.2	14.10
T ₉ - Fertigation of 50% GRDN as per STCR+ biofertilizer for 200 t/ha	203.4	29.56	3.33	82.71	301.22	23.84	10.3	14.52
T ₁₀ -Fertigation of 25% GRDN as per STCR for 200 t/ha	186.5	25.92	3.22	79.93	287.11	24.56	10.1	13.92
T ₁₁ -Fertigation of 25% GRDN as per STCR+ biofertilizer for 200 t/ha	189.9	27.13	3.18	80.02	275.22	23.78	10.1	14.28
S.E.D	4.21	1.04		1.22	9.23	1.09	0.09	0.45
CD at 5%	8.79	2.17		2.54	19.27	2.27	0.19	0.95

Conclusion

To conclude, soil test crop response (STCR) targets yield equation technique and bio fertilizer were achieving sugarcane yield of 200 t/ha for plant cane crop in medium deep black soil. The pooled data of two plant cane crop showed that the highest and significant cane yield of 210.73 t/ha (5.1% more than the targeted yield of 200 t/ha) in plant cane crop was achieved by 100% STCR dose of NPK along with bio fertilizers. However the target (203.5 t/ha) was achieved in 50% of STCR dose with judicious use of bio fertilizers.

It indicates that fertilizer dose (NPK) can be reduced to 50% of the total dose worked out by STCR technique along with the bio fertilizer to achieve cane yield of 200 t/ha in plant cane crop and 125 t/ha in ratoon crop.

References

1. Bera R, Seal A, Bhattacharyya P, Das TH, Sarkar D, Kangjoo K. Targeted yield concept and a framework of fertilizer recommendation in irrigated rice domains of subtropical India. *Journal of Zhejiang University Science*. 2006;7(12):963-968.
2. Ghube NB, Kadlag AD, Kamble BM. Soil test crop response based integrated plant nutrition system for desired yield target of pre seasonal sugarcane ratoon on Inceptisols. *Journal of Applied and Natural Science*. 2017;9(2):799-804.
3. Gomez KA, Gomez AA. Statistical procedure for Agricultural research with spatial emphasis on rice. Los Banos, Philippines: International Rice Research Institute; c1978. p. 386.
4. Jackson ML. Soil chemical analysis. New Delhi: Prentice Hall of India Private Limited; c1973.
5. Jyothi BA, Asha T, Sriyaya T, Ramana Reddy DV, Madhavi A, Surendra Babu P, *et al.* Soil test based targeted yield equations for ratoon sugarcane in alluvial soils. *International Journal of Chemical Studies*. 2020;8(5):2556-2560.
6. Kanwar JS. Soil testing service in India-retrospect and prospect. *Proceedings of International Symposium on*

Soil Fertility Evaluation; New Delhi; c1971. p. 1103-1113.

7. Ramamoorthy B, Narsimhan RL, Dinesh RS. Fertilizer application for specific yield targets of Sonora-64 (wheat). *Indian Farming*. 1967;25(5):43-45.
8. Truog E. Fifty years of soil testing. *Transactions of the 7th International Congress of Soil Science*; Madison, Wisconsin, USA. 1960;(III, IV):36-45.