*IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)*
*e-ISSN: 2319-2380, p-ISSN: 2319-2372. Volume 15, Issue 5 Ser. I (May 2022), PP 21-24*
*www.iosrjournals.org*

# A Comparative Study on STCR based Fertilizer Application and Farmer's Fertilizer Practice (FFP) on *Zea mays*

Dr.Bijaylakhmi Goswami
*Co-Founder and Head, Research and Development, Agrithink Services LLP, India*

Priyadi Nunisa
*Project Assistant, Agrithink Services LLP, India*

***Abstract:***
*Soil fertility management is the key to optimize potential yield. Soil nutrient management cannot be précised if nutrient status of the field is not taken into account. A feasible way of optimum use of soil nutrients as well as applied fertilizer is Soil Test Crop Response based application with a targeted yield. Realizing the huge gap between Farmer's Fertilizer Practices and Soil Test Crop Response based application and to find out the relative economic advantages this study was carried out.*

*Field Level Demonstration of maize on 20 different locations of Morigaon District of Assam was conducted to compare the different nutrient management approaches. Target yield was taken as 50ql/ha. The mean initial nutrient status in these location was 104.65 N kg/ha, 28.95 P $_2O_5$ Kg/ha, 178.8 K $_2O$ kg/ha.*

*On an average, the mean fertilizer requirement on STCR approach for crop was found to be 188.10 N kg/ha, 99.60 $P_2O_5$ Kg/ha, 111.31 $K_2O$ kg/ha. On the other hand under Farmer's Fertilizer Practice (FFP), the mean rate of application was 97.40 N kg/ha, 26.55 P $_2O_5$ Kg/ha, 6.00 K $_2O$ kg/ha. In STCR plots the yield was in the range of 43-50 ql/ha with a mean grain yield of 47.05 ql/ha while in FFP mean yield was 37.2 ql/ha. The mean relative income in STCR treatment over FFP was found to be Rs. 12327.70/- .*

***Key Word*:** *Farmer's Fertilizer Practice(FFP), STCR, Zea Mays, Field Level Demonstration, Target Yield*

---

Date of Submission: 04-05-2022 Date of Acceptance: 19-05-2022

---

## I. Introduction

Maize (*Zea mays* L.) , the queen of cereals , is a member of the grass family *Poaceae*, or true grasses and is world's third most important food crop after rice and wheat. It is an essential staple cereal crop. In India, maize is used as human food (23%), poultry feed (51 %), animal feed (12 %), industrial (starch) products (12%), beverages and seed (1 % each). In addition, it is basic raw material as an ingredient to thousands of industrial products that includes starch, oil, protein, alcoholic beverages, food sweeteners, pharmaceutical, cosmetic, film, textile, gum, package and paper industries etc. In Assam , maize occupies an area of 23.7 thousand hectare with a production of 21.3 thousand tonnes (IPNI Canada, 2012-13). The grain yield of maize depends on the genetic potential of the genotype used, the characteristics of the soil, the field management practices, and agro-climatic factors (Van I. *et al.*, 1997 and Liu *et al.*, 2018). To meet the growing demands of maize in the era of climate change is a big challenge. Meeting such challenge is possible only through science-based technology interventions like soil testing, application of novel production techniques, need based nutrient management. The Soil Test Crop Response (STCR) is cost effective and allow us to provide plant need based nutrient which results in higher yield. It also aims to apply nutrients at optimal rates and time to achieve target yield and higher efficiency of nutrient use by the crop, leading to more net returns per unit of fertilizer invested. Soil test calibration permits balanced fertilization through right kind and amount of fertilizers. In this regard, targeted yield approach had been found to be beneficial recommending balanced fertilization considering the soil available nutrient status and crop needs (Ramamoorthy *et al.*,1967). The present investigation was under taken in farmer's fields to popularize fertilizer prescription equations of yield target approach in maize. The specific yield equation based on soil health 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).

## II. Materials And Method

The Experiment was conducted in Morigaon district of Assam. About 20 farmers of different locations of Morigaon district were selected during Rabi season in 2020-21. The objective of the study was to compare the different nutrient management approaches on yield of maize. The variety of maize used during experiment was Ganga 101. Two nutrient management approaches viz. Farmer Fertilizers Practice (FFP) and Targeted yield were selected . Initially soil available nutrients were analyzed to compute the target yield equations. Target yield was taken as 50ql/ha. Under STCR with targeted yield nutrient requirement to obtain 50ql/ha of yield was calculated using initial soil fertility status with the following equations -

FN = 4.25T─ 0.25SN
FP = 3.43T─ 3.62SP
FK = 2.25T─ 0.17SK

In the above equation, FN, FP2O5, FK2O represents the fertilizer Nitrogen, Phosphorus and Potassium in kg/ha. T means the target yield in ql/ha and SN, SP and SK are soil available N, P and K respectively.

Initially soil samples were collected at each location and pH, electrical conductivity, organic carbon and available N P K were analysed using Agrithink's Smart Soil Health Management System(Soilcare) which is an IoT based instant, in-situ soil testing system. The nutrient analyzed revealed that the soil is acidic and has low available N P K. Nitrogen requirement in both the treatments were applied in three splits , $1/3^{rd}$ at base, $1/3^{rd}$ at knee height, last $1/3^{rd}$ at tasseling stage. Phosphorus and potassium were applied as basal dose. Urea, SSP and MOP were used for supply of NPK.

Time to time interaction with farmers were held during experiment period. Farmer's Field Practice was observed while STCR application was guided. Other operations were based on standard package of practices for the tested maize variety. After completion of harvesting the produce was marketed at local Market price and relative income from the two approaches was compared. Govt. price of urea, SSP and MOP were taken for relative income analysis.

## III. Result And Discussion

It was found that most of the farmers under FFP were concentrating in applications of Nitrogenous fertilizer over phosphorus and potassium and some ended up using more nitrogenous fertilizer than required. In most of the locations farmers following FFP did not apply balanced fertilizer compared to fertilizer recommendations as in guided STCR plots.

Under FFP, yield of maize for 20 plot ranges from 33- 43 ql/ha, with a mean yield of 37.2 ql/ha. Under STCR with Targeted yield it was 42- 50 ql/ha with a mean yield of 47.05 ql/ha.

STCR technology resulted an additional mean yield of 9.85 ql/ha over FFP. This might be due to application of fertilizer based on soil nutrient supply and need of crop. Need based application of fertilizer resulted better assimilations of *photosynthates* Madhavi A.*et al.* (2020). Similar results were also obtained by Ray *et al.*(2000), Meena *et.al* (2001), Arun K. *et al*.(2007), Jayprakash *et al*.(2006), Umesh (2008), Vikram *et al*. (2015), Kumar P. and Paramanand (2018) and Prabhakar R. *et al.* (2018).

In the experiment an additional cost of fertilizer ranging from Rs 4227.00/- to Rs 10,323.90/- with a mean of Rs 7372.30/-was observed in STCR treatment over FFP which was due to balanced use of fertilizer in the STCR treatments. Even then relative income gain due to fertilizer use and yield between the two treatments were found to be in the range of Rs 119.10/- to Rs 20626.80/- with a mean of Rs 12,327.70/-. This was due to higher productivity and gross returns in the STCR Target Yield approach over FFP. Similar results are reported by Kumar P. and Parmanand (2018).

**Table.1 Physico- chemical properties of selected farmer's fields**

| sl .no | Farmer's Name | N(kg ha-1) | $P_2O_5$(kg ha-1) | $K_2O$(kg ha-1) | pH | EC (dS/m) | OC(%) |
|---|---|---|---|---|---|---|---|
| 1 | F1 | 72 | 22 | 158 | 4.8 | 0.05 | 0.33 |
| 2 | F2 | 75 | 30 | 176 | 4.9 | 0.04 | 0.34 |
| 3 | F3 | 80 | 35 | 157 | 5.1 | 0.06 | 0.37 |
| 4 | F4 | 73 | 20 | 186 | 4.8 | 0.02 | 0.33 |
| 5 | F5 | 110 | 26 | 198 | 5.5 | 0.04 | 0.51 |
| 6 | F6 | 95 | 23 | 161 | 5.3 | 0.05 | 0.44 |
| 7 | F7 | 87 | 31 | 174 | 5.1 | 0.03 | 0.40 |
| 8 | F8 | 90 | 37 | 183 | 5.6 | 0.02 | 0.42 |
| 9 | F9 | 71 | 30 | 167 | 5.8 | 0.03 | 0.32 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 10 | F10 | 98 | 28 | 179 | 5 | 0.04 | 0.46 |
| 11 | F11 | 121 | 22 | 180 | 5.9 | 0.03 | 0.57 |
| 12 | F12 | 112 | 20 | 191 | 5.7 | 0.02 | 0.52 |
| 13 | F13 | 143 | 26 | 177 | 6 | 0.01 | 0.68 |
| 14 | F14 | 96 | 20 | 186 | 6.3 | 0.04 | 0.45 |
| 15 | F15 | 75 | 37 | 171 | 5.4 | 0.03 | 0.34 |
| 16 | F16 | 115 | 38 | 188 | 6.8 | 0.06 | 0.54 |
| 17 | F17 | 149 | 42 | 187 | 6.2 | 0.07 | 0.71 |
| 18 | F18 | 133 | 36 | 196 | 6.4 | 0.06 | 0.63 |
| 19 | F19 | 148 | 27 | 185 | 5.8 | 0.04 | 0.70 |
| 20 | F20 | 150 | 29 | 176 | 5.7 | 0.06 | 0.71 |

**Table.2 Fertilizer application rates in FFP and STCR**

| | | **Farmer Fertilizer Practice (FFP) (kg ha-1)** | | | **STCR Fertilizer Recommendation (kg ha-1)** | | |
|---|---|---|---|---|---|---|---|
| **Sl no.** | **Farmer no.** | **N** | **$P_2O_5$** | **$K_2O$** | **N** | **$P_2O_5$** | **$K_2O$** |
| 1 | F 1 | 100 | 25 | 30 | 187.5 | 106 | 107.4 |
| 2 | F2 | 110 | 35 | 0 | 185 | 69.8 | 112.5 |
| 3 | F 3 | 84 | 44 | 0 | 191.5 | 37.22 | 112.5 |
| 4 | F 4 | 98 | 30 | 0 | 188 | 87.9 | 112.5 |
| 5 | F5 | 67 | 22 | 0 | 195.75 | 116.86 | 112.5 |
| 6 | F6 | 105 | 35 | 26 | 186.25 | 69.8 | 108.08 |
| 7 | F 7 | 85 | 27 | 0 | 191.25 | 98.76 | 112.5 |
| 8 | F 8 | 92 | 25 | 0 | 189.5 | 106 | 112.5 |
| 9 | F 9 | 120 | 33 | 16 | 182.5 | 77.04 | 109.78 |
| 10 | F 10 | 88 | 36 | 0 | 190.5 | 66.18 | 112.5 |
| 11 | F 11 | 94 | 17 | 0 | 189 | 134.96 | 112.5 |
| 12 | F 12 | 104 | 27 | 18 | 186.5 | 98.76 | 109.44 |
| 13 | F 13 | 109 | 15 | 0 | 185.25 | 142.2 | 112.5 |
| 14 | F 14 | 100 | 30 | 0 | 186.5 | 72.2 | 109.2 |
| 15 | F 15 | 100 | 22 | 20 | 187.5 | 116.86 | 109.1 |
| 16 | F 16 | 112 | 27 | 0 | 184.5 | 98.76 | 112.5 |
| 17 | F 17 | 107 | 29 | 0 | 185.75 | 91.52 | 112.5 |
| 18 | F18 | 92 | 18 | 10 | 189.5 | 131.34 | 110.8 |
| 19 | F19 | 96 | 14 | 0 | 188.5 | 145.82 | 112.5 |
| 20 | F 20 | 85 | 20 | 0 | 191.25 | 124.1 | 112.5 |
| | **Mean** | **97.4** | **26.55** | **6** | **188.1** | **99.604** | **111.315** |

**Table.3 Grain yield and change in grain yield of maize between FFP and STCR**

| Sl.no | Farmer no. | Grain yield (qlha-1) | | Change grain yield(qlha-1) | Total cost fertilizer(Rs.ha-1) | | Total difference in amount(Rs) | Gross return (Rs ha -1) | | Gross Return over Fertilizer cost (Rs.ha-1) | | Relative Income (Rs.Over FFP) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | FFP | STCR | over FFP | FFP | STCR | | FFP | STCR | FFP | STCR | |
| 1 | F1 | 43 | 50 | 7 | 3171.5 | 10113.8 | 6942.3 | 86000 | 100000 | 82828.5 | 89886.2 | 7057.7 |
| 2 | F2 | 33 | 43 | 10 | 2865.5 | 8595.4 | 5729.9 | 66000 | 86000 | 63134.5 | 77404.6 | 14270.1 |
| 3 | F3 | 35 | 45 | 10 | 2969.8 | 7196.8 | 4227.0 | 70000 | 90000 | 67030.2 | 82803.2 | 15773.0 |
| 4 | F4 | 34 | 47 | 13 | 2499.4 | 9449.3 | 6949.9 | 68000 | 94000 | 65500.6 | 84550.7 | 19050.1 |
| 5 | F5 | 34 | 47 | 13 | 1776.2 | 10850.1 | 9073.9 | 68000 | 94000 | 66223.8 | 83149.9 | 16926.1 |
| 6 | F6 | 42 | 49 | 7 | 3565.6 | 8481 | 4915.4 | 84000 | 98000 | 80434.4 | 89519 | 9084.6 |
| 7 | F7 | 37 | 50 | 13 | 2212.2 | 9978.6 | 7766.4 | 74000 | 100000 | 71787.8 | 90021.4 | 18233.6 |
| 8 | F8 | 38 | 50 | 12 | 2203.3 | 10285.8 | 8082.5 | 76000 | 100000 | 73796.7 | 89714.2 | 15917.5 |
| 9 | F9 | 39 | 48 | 9 | 3358.2 | 8814.5 | 5456.3 | 78000 | 96000 | 74641.8 | 87185.5 | 12543.7 |
| 10 | F10 | 32 | 44 | 12 | 2654.4 | 8495.6 | 5841.2 | 64000 | 88000 | 61345.6 | 79504.4 | 18158.8 |
| 11 | F11 | 34 | 45 | 11 | 1864.6 | 11590.5 | 9725.9 | 68000 | 90000 | 66135.4 | 78409.5 | 12274.1 |
| 12 | F12 | 43 | 47 | 4 | 2985.6 | 9834 | 6848.4 | 86000 | 94000 | 83014.4 | 84166 | 1151.6 |
| 13 | F13 | 39 | 48 | 9 | 1948.8 | 11874.4 | 9925.6 | 78000 | 96000 | 76051.2 | 84125.6 | 8074.4 |
| 14 | F14 | 38 | 49 | 11 | 2522.7 | 9443.5 | 6920.8 | 76000 | 98000 | 73477.3 | 88556.5 | 15079.2 |
| 15 | F15 | 43 | 46 | 3 | 2744.1 | 8625 | 5880.9 | 86000 | 92000 | 83255.9 | 83375 | 119.1 |
| 16 | F16 | 36 | 50 | 14 | 2526.8 | 9900 | 7373.2 | 72000 | 100000 | 69473.2 | 90100 | 20626.8 |
| 17 | F17 | 38 | 49 | 11 | 2559.0 | 9586.9 | 7027.9 | 76000 | 98000 | 73441.0 | 88413.1 | 14972.1 |
| 18 | F18 | 37 | 46 | 9 | 2178.2 | 11382.9 | 9204.7 | 74000 | 92000 | 71821.8 | 80617.1 | 8795.3 |
| 19 | F19 | 36 | 45 | 9 | 1752.1 | 12076 | 10323.9 | 72000 | 90000 | 70247.9 | 77924 | 7676.1 |
| 20 | F20 | 33 | 43 | 10 | 1895.4 | 11125.3 | 9229.9 | 66000 | 86000 | 64104.6 | 74874.7 | 10770.1 |
| | **Mean** | **37.2** | **47.05** | **9.85** | **2512.7** | **9884.97** | **7372.3** | **74400** | **94100** | **71887.3** | **84215.03** | **12327.7** |

## IV. Conclusion

The comparative analysis on grain yield and income from maize cultivation under Farmer's Fertilizer Practice and Targeted yield with Soil Test and Crop Response approach clearly showed that application of balanced fertilizer can enhance profitability by increasing yield as per target. Though sometimes fertilizer cost under balanced application is higher, the marked increase in production has a positive impact on farmer's economic return.

## References


[1]. Arun Kumar, Gali SK and Hebsur S.(2007). Effect of Different Levels of NPK on Gowth and Yield Parameters of Sweet Corn. *Karnataka J. Agric. Sci.* 20(1): 41-43.

[2]. Bera R, Seal A, Bhattacharyya P, Das T H, Sarkar D and Kangjoo K. (2006). Targeted Yield Concept and a Framework of Fertilizer Recommendation in Irrigated Rice Domains of Subtropical India. Journal of Zhejiang Univ Sci. 7(12): 963- 968.

[3]. http://sap.ipni.net/article/assam

[4]. Jayprakash TC, Nagalikar VP, Pujari BT and Setty RA. (2006). Effect of Organics and Inorganics on Growth and Yield of Maize under Irrigation. Karnataka J. Agric. Sci. 18(3): 798.

[5]. Liu Z, Yang X, Lin X, Hubbard KG, Lv S, Wang J.(2016). Narrowing the agronomic yield gaps of maize by improved soil, cultivar, and agricultural management practices in different climate zones of Northeast China. Earth Interact 20: 1–18.

[6]. Madhavi A, Srijaya T, Babu Surendra P, Dey P. (2020). Popularization of STCR Targeted Yield for Optimum Fertilizer Use and Enhanced Yields of Maize Crop through Field Level Demonstrations . *Int.J.Curr.Microbiol.App.Sci. 9*(8): 2209-2214

[7]. Meena M, Ahmed S, Riazuddin M, Chandrasekhara KR, Rao BRCP. (2001). Soil Test Crop Response Calibration Studies on Onion (*Allium cepa*) in Alfisols. Journal of Indian Society of Soil Science 49: 709-713.

[8]. Prabhakar Reddy T, Madhavi A, Srijaya T and Vijayalakshmi D.( 2018). Field Validation of Soil Test and Yield Target Based Fertilizer Prescription Equation for Soybean on Vertisol. Journal of Pharmacognosy and Phytochemistry. 7(6): 1159-1162.

[9]. Pradeep Kumar and Parmanand.(2018) .Evaluation of Soil Test Crop Response Approach for Sustainable Crop Production of Rice in Baladobazar – Bhatapara District of Chhattisgarh. International Journal of Current Microbiology and Applied Science Special Issue 7:3513- 3518.

[10]. Ramamoorthy B, Narsimhan R L and Dinesh R S. (1967). Fertilizer Application for Specific Yield Targets of Sonora-64(wheat). Indian Farming. 25(5): 43 - 45.

[11]. Ray PK, Jana AK, Maitra DN, Saha MN, Chaudhury J, Saha S, Saha AR. (2000). Fertilizer Prescription for Soil Test Basis for Jute, Rice and Wheat in Typic Ustrochept. Journal of Indian Society of Soil Science 48: 79-84.

[12]. Umesh M R.(2008). Investigation on Balanced Fertilization for Maize– Pigeonpea Cropping Sequence in *Alfisols* of Karnataka. *Ph.D. Thesis.* Univ. Agric. Sci., Bangalore.

[13]. Vikram AP, Birdar DP, Umesh MR, Basavanneppa M A and Narayana Rao K. (2015). Effect of Nutrient Management Techniques on Growth, Yield and Economics of Hybrid Maize (*Zea mays* L.) in Vertisols. Karnataka J. Agric. Sci. 28(4): 477-481.

[14]. Van Ittersum MK, Rabbinge R.(1997). Concepts in production ecology for analysis and quantification of agricultural input-output combinations. *Field Crops Res. 52*, 197–208.