*Available online at* www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.5223

**ISSN: 2320 – 7051**

*Int. J. Pure App. Biosci.* **6 (2):** 476-480 (2018)

*Research Article*

International Journal of Pure & Applied Bioscience

OPEN ACCESS

# Growth Parameters and Yield of Maize (*Zea mays* L.) as Influenced by Target Yield Approach under Irrigated Situation

**Santosh Pagad, M. P. Potdar, H. T. Chetan*, B. T. Nadagouda and Gurupada B. Balol**

Department of Agronomy, University of Agricultural Sciences, Dharwad (Karnataka)

*Corresponding Author E-mail: chethanagron@gmail.com

Received: 15.07.2017 | Revised: 22.08.2017 | Accepted: 28.08.2017

**ABSTRACT**

*The experiment was conducted during kharif 2013 in vertisols at Agricultural Research Station, Mudhol, Karnataka to study growth and yield of maize (Zea mays L.) as influenced by target yield approach under irrigated situation. The results of the experiment revealed that application of nutrients to achieve target yield of 140 q ha$^{-1}$ (380.8: 133.9: 88.2 kg N, $P_2O_5$, $K_2O$ ha$^{-1}$) recorded significantly higher growth parameters namely plant height, number of leaves per plant, leaf area, leaf area duration (LAD) and stem girth at different growth stages of crop. Significantly higher grain yield (128.26 q ha$^{-1}$) and stover yield (150.65 q ha$^{-1}$) was recorded by target yield level of 140 q ha$^{-1}$. The increase in grain and stover yield by target yield level of 140 q ha$^{-1}$ could be the maximum plant height (206.1, 223 and 225.3 cm at 60, 90 DAS and harvest, respectively), number of leaves per plant (9.2, 14.2, 13.3 and 6.5 at 30, 60, 90 DAS and harvest, respectively), leaf area (76.64, 68.94 and 29.48 dm $^{2}$ at 60, 90 DAS and harvest, respectively), leaf area duration (100.58, 92.56 and 42.58 between 30-60 DAS, 60-90 DAS and 90 DAS-harvest, respectively), stem girth (5.45, 6.05 and 6.67 at 30, 60 and 90 DAS, respectively), gross returns (Rs. 1,70,590 ha$^{-1}$) and net returns (Rs. 1,25,104 ha$^{-1}$) as compared to absolute control.*

***Key words:*** *Target yield, Phenolgical stages, Growth parameters, Yield.*

## INTRODUCTION

Maize a thermo-insensitive, long day *kharif* cereal adopts well to the diverse climatic conditions. With the introduction of high yielding varieties of maize, use of high analysis chemical fertilizer and monocropping practices gained popularity. This led to systematic mining of soils for major nutrients such as nitrogen, phosphorus and potassium resulting in wide spread low harvest of poor quality grains. Adequate nutrition therefore, is important but the emphasis should also be given on the dosage in commensuration with the crop need pattern otherwise nutrients like nitrogen are subjected for loss resulting in low use efficiency of added nutrients besides low and poor quality produce.

A genotype, however superior it may be, cannot achieve its full potential unless it is put into an enabling agronomic context. In future, comprehensive agronomic service packs would be available combining the best of precision agriculture technologies with intelligent management practices.

**Cite this article:** Pagad, S., Potdar, M.P., Chetan, H.T., Nadagouda, B.T. and Balol, G.B., Growth Parameters and Yield of Maize (*Zea mays* L.) as Influenced By Target Yield Approach Under Irrigated Situation, *Int. J. Pure App. Biosci.* **6(2):** 476-480 (2018). doi: http://dx.doi.org/10.18782/2320-7051.5223

Customized agronomic consultancy services will be order of the day. Agronomic techniques based on precision agriculture have the potential to change the sustainability aspect dramatically.

Precision agriculture is a management strategy that employs detailed site specific information to precisely manage production inputs. Precision farming can contribute in many ways to long-term sustainability of agriculture. The idea is to know the soil and crop characteristics unique to each part of the field and to optimize the production inputs within small portions of the field. Of all the production inputs, nutrients occupy the top position and nutrient management is crucial to the success of any farming system. The usual practice is to apply nutrients at one rate throughout the farming area. Such practice could lead to wastage of resources and maximum yields could not be achieved since, spatial variability is altogether ignored in the management option. Precision nutrient management system offers improved land stewardship, optimizes resource usage, since every part of a field receives precise amount of fertilizer required to maximize crop yields. Various strategies of precision nutrient management system are being developed among which management zone technique and site-specific nutrient management are gaining importance Hence the present investigation is carried out to growth and yield of maize as influenced by target yield approach under irrigated situation.

## MATERIAL AND METHODS

A Field experiment was conducted during *kharif* 2013 at Agricultural Research Station Mudhol, University of Agricultural Sciences, Dharwad. It is located in Bagalkot district in the northern part of Karnataka State at 160 20" N latitude, 750 15" E longitude and at an altitude of 577.6 meters above mean sea level. The soil of the experimental field was vertisol with pH 8.5, EC (0.25 ds $m^{-1}$) and organic carbon (0.44 %). Nutrient status for the entire study area was low in available nitrogen (131 kg $ha^{-1}$), low in phosphorus (20.46 kg $ha^{-1}$) and high in potash (1082 kg $ha^{-1}$) (LLH management zone). The experiment was laid out in randomized block design and replicated four times with seven treatments *viz*., $T_1$- 60 q $ha^{-1}$, $T_2$- 80 q $ha^{-1}$, $T_3$- 100 q $ha^{-1}$, $T_4$- 120 q $ha^{-1}$, $T_5$- 140 q $ha^{-1}$, $T_6$- Recommended dose of fertilizer (RDF) and $T_7$- Absolute control. 10 % N and entire dose of $P_2O_5$ and $K_2O$ was applied at the time of sowing in the form of urea, single super phosphate and muriate of potash respectively. The fertilizers were applied by placing along the lines 5 cm away and 5 cm below the seed rows. Sowing of maize was done on 17$^{th}$ August 2013 with a spacing of 60 cm between rows and 20 cm between plants. The remaining amount of nitrogen was applied in four split dosage at 25 (20 % N), 35 (30 % N), 55 (30 % N) and at 65 DAS (10 % N) which coincide with different phonological stages like$V_2$ - Collar of 2$^{nd}$ leaf visible, $V_7$ - Collar of 7$^{th}$ leaf visible, $V_{12}$ - Collar of 12$^{th}$ leaf visible and Tasseling respectively. All the plots were uniformly irrigated as and when required based on soil moisture content and phenological stages of the crop growth. Total three irrigations were provided to crop. Harvesting was done, when the sheath of the cob dried completely.

## RESULT AND DISCUSSION

Significantly highest grain yield (128.26 q $ha^{-1}$) and stover yield (150.65 q $ha^{-1}$) was obtained by 140 q ha-1 as compared to other target yields. However, it was on par with target yield of 120 and 100 q $ha^{-1}$. The increase in maize grain yield and stover yield with target yield of 140 q ha-1 was to the tune of 61.5 and 25.28 per cent over RDF respectively (Table 1). The higher grain and stover yield of maize was mainly due to better translocation of photosynthates from source to sink and higher growth attributing characters like higher number of leaves, leaf area and higher dry matter production and its accumulation into different parts of plant and yield attributing and also due to higher availability of nutrients resulted in better uptake of N, $P_2O_5$ and $K_2O$. These results are in accordance with the findings of Biradar *et al*.[1], and Sreelatha *et al*[9].

Plant height varied significantly due to the effect of application of nutrients to achieve target yield levels at all the stages of plant growth except at 30 DAS (Table 2). Significantly higher plant height (206.1, 223.0 and 225.3 cm at 60, 90 DAS and harvest, respectively) was recorded with target yield of 140 q $ha^{-1}$ as compared to absolute control. The higher total plant height might be due to higher dry matter accumulation in stem, leaves and reproductive parts at all the growth stages and it is the reflection of photosynthetic efficiency of cultivar at the nutrition level supplied. Significantly higher number of leaves was recorded in targeted yield level of 140 q $ha^{-1}$ (9.2, 14.2, 13.3 and 6.5 per plant at 30, 60, 90 DAS and harvest, respectively) as compared to absolute control among different target yield levels (Table 2). The higher nutrient uptake right from in early stage of crop growth may be one of the reasons for improved vegetative growth. Similar results were also have been revealed by Jemal Abdulai[7] and Daikho[4].

Results showed that the leaf area (Table 3) tended to increase up to 60 DAS beyond which it declined towards harvest, which was due to senescence of foliage. Leaf area was influenced markedly due to target yield based fertilizer application. Increasing target yield levels from 60 to 140 q $ha^{-1}$ significantly increased leaf area at all the crop growth stages except at 30 DAS. Significantly higher leaf area (76.64, 68.94 and 29.48 $dm^{2}$ at 60, 90 DAS and harvest, respectively) was recorded with application of nutrients for target yield of 140 q $ha^{-1}$ as compared to absolute control. At different growth periods, application of higher doses of nitrogen favored the crop to put forth more leaf area and also might be due to increased nitrogen supply to increase auxin activity, production of carbohydrates and organic compounds leading to accelerate meristematic activity at the shoot apex which intern increased leaf area. The results were in line with findings of Sarnaik[8] and Daikho[4].

Among different target yield levels, significantly, higher LAD was recorded with targeted yield level of 140 q $ha^{-1}$ (100.58, 92.56 and 42.61 between 30-60DAS, 60-90DAS and 90DAS-harvest, respectively) as compared to absolute control (Table 3). The relevance of higher LAD was clearly brought out by Watson[11]. According to whom the formation of optimum photosynthetic area and maintaining the leaf photo synthetically active stage for longer period were essential for increasing grain yield. The improved photosynthetic capacity was associated with higher N, $P_2O_5$ and $K_2O$ nutrition as indicated by better uptake of major nutrients. All the three elements (N, $P_2O_5$ and $K_2O$) are critically involved in photosynthesis and dry matter production[10].

Stem girth are important growth parameters which influence carbon storage and its subsequent utilization for grain filling in maize. These are cases where the utilization of stem reserves for grain filling in constitutive irrespective of environmental conditions[3]. Among different target yield levels, significantly, higher stem girth was recorded with targeted yield level of 140 q $ha^{-1}$ (5.45, 6.05 and 6.67 cm at 30, 60 and 90 DAS, respectively) as compared to absolute control (Table 4). This improved vegetative growth has laid down foundation for better infrastructure for dry matter production and ultimately lead to better yield of the crop. The higher nutrient uptake right from in early stage of crop growth may be one of the reasons for improved vegetative growth. These results are agreement with Jemal Abdulai[7].

The significant difference in the gross return, net returns and B:C ratio was observed due to precision nutrient management (Table 4). Significantly higher gross returns (Rs. 1,70,590 $ha^{-1}$), net returns (Rs. 1,25,104 $ha^{-1}$) and was recorded in target yield of 140 q $ha^{-1}$ as as compared to absolute control. The results were in close proximity with the findings of Biradar *et al.*[2] and Jemal[7]. However benefit cost ratio was higher in application of nutrients for target yield of 120 q $ha^{-1}$ (3.89) followed by target yield of 100 (3.78) and 140 q $ha^{-1}$ (3.75). This was mainly due to less quantity of fertilizer used compared to target yield of 140 q $ha^{-1}$ and produced on par grain yield.

**Table 1: Grain yield and stover yield of maize as influenced by target yield approach**

| Treatment | Grain yield ( q ha $^{-1}$) | Stover yield (q ha $^{-1}$) |
|---|---|---|
| $T_1$-Target yield 60 q ha $^{-1}$ | 82.20 | 123.75 |
| $T_2$-Target yield 80 q ha $^{-1}$ | 96.10 | 130.05 |
| $T_3$-Target yield 100 q ha $^{-1}$ | 108.65 | 136.67 |
| $T_4$-Target yield 120 q ha $^{-1}$ | 119.77 | 143.56 |
| $T_5$-Target yield 140 q ha $^{-1}$ | 128.26 | 150.65 |
| $T_6$- RDF | 79.39 | 120.26 |
| $T_7$- Absolute control | 28.19 | 52.04 |
| S.Em± | 3.66 | 6.90 |
| CD (P=0.05) | 10.87 | 20.49 |

$T_1$: 163.2: 57.4: 37.8 N, $P_2O_5$ and $K_2O$ kg ha $^{-1}$ $T_4$: 326.4: 114.8: 75.6 N, $P_2O_5$ and $K_2O$ kg ha $^{-1}$
$T_2$: 217.6: 76.5: 50.4 N, $P_2O_5$ and $K_2O$ kg ha $^{-1}$ $T_5$: 380.8: 133.9: 88.2 N, $P_2O_5$ and $K_2O$ kg ha $^{-1}$
$T_3$: 272.0: 95.7: 63.0 N, $P_2O_5$ and $K_2O$ kg ha $^{-1}$ $T_6$: 150.0: 65.0: 65.0 N, $P_2O_5$ and $K_2O$ kg ha $^{-1}$

**Table 2: Plant height and number of green leaves plant $^{-1}$ of maize as influenced by target yield approach**

| Treatment | Plant height (cm) | | | | Number of green leaves plant $^{-1}$ | | | |
|---|---|---|---|---|---|---|---|---|
| | 30 DAS | 60 DAS | 90 DAS | At harvest | 30 DAS | 60 DAS | 90 DAS | At harvest |
| $T_1$-Target yield 60 q ha $^{-1}$ | 37.9 | 183.6 | 201.3 | 202.3 | 8.4 | 13.2 | 10.8 | 4.3 |
| $T_2$-Target yield 80 q ha $^{-1}$ | 38.9 | 191.3 | 209.4 | 210.9 | 8.7 | 13.6 | 11.5 | 5.1 |
| $T_3$-Target yield 100 q ha $^{-1}$ | 39.6 | 197.2 | 215.1 | 217.0 | 8.9 | 13.8 | 12.2 | 5.7 |
| $T_4$-Target yield 120 q ha $^{-1}$ | 40.0 | 202.3 | 219.4 | 222.4 | 9.1 | 14.0 | 12.7 | 6.2 |
| $T_5$-Target yield 140 q ha $^{-1}$ | 40.3 | 206.1 | 223.0 | 225.3 | 9.2 | 14.2 | 13.3 | 6.5 |
| $T_6$- RDF | 37.6 | 182.4 | 199.7 | 201.5 | 8.3 | 13.1 | 10.5 | 4.1 |
| $T_7$- Absolute control | 36.4 | 130.3 | 163.7 | 164.3 | 8.0 | 12.2 | 8.1 | 2.2 |
| S.Em± | 1.61 | 6.1 | 4.0 | 4.4 | 0.3 | 0.3 | 0.6 | 0.4 |
| CD (P=0.05) | NS | 18.3 | 11.9 | 13.1 | 0.9 | 0.8 | 1.7 | 1.2 |

$T_1$: 163.2: 57.4: 37.8 N, $P_2O_5$ and $K_2O$ kg ha $^{-1}$ $T_4$: 326.4: 114.8: 75.6 N, $P_2O_5$ and $K_2O$ kg ha $^{-1}$
$T_2$: 217.6: 76.5: 50.4 N, $P_2O_5$ and $K_2O$ kg ha $^{-1}$ $T_5$: 380.8: 133.9: 88.2 N, $P_2O_5$ and $K_2O$ kg ha $^{-1}$
$T_3$: 272.0: 95.7: 63.0 N, $P_2O_5$ and $K_2O$ kg ha $^{-1}$ $T_6$: 150.0: 65.0: 65.0 N, $P_2O_5$ and $K_2O$ kg ha $^{-1}$

**Table 3: Leaf area and leaf area duration of maize as influenced by target yield approach**

| Treatment | Leaf area ($dm^2$) | | | | Leaf area duration | | |
|---|---|---|---|---|---|---|---|
| | 30 DAS | 60 DAS | 90 DAS | At harvest | 30-60 DAS | 60-90 DAS | 90 DAS-harvest |
| $T_1$-Target yield 60 q ha $^{-1}$ | 3.59 | 49.31 | 46.31 | 16.57 | 66.15 | 62.01 | 24.56 |
| $T_2$-Target yield 80 q ha $^{-1}$ | 3.65 | 54.20 | 51.82 | 21.34 | 72.34 | 69.32 | 30.98 |
| $T_3$-Target yield 100 q ha $^{-1}$ | 3.71 | 59.63 | 56.68 | 23.95 | 79.13 | 75.84 | 34.65 |
| $T_4$-Target yield 120 q ha $^{-1}$ | 3.74 | 67.31 | 62.37 | 26.40 | 88.84 | 83.61 | 38.20 |
| $T_5$-Target yield 140 q ha $^{-1}$ | 3.80 | 76.64 | 68.94 | 29.48 | 100.58 | 92.56 | 42.61 |
| $T_6$- RDF | 3.42 | 45.73 | 42.19 | 14.18 | 61.50 | 56.58 | 21.22 |
| $T_7$- Absolute control | 3.25 | 25.39 | 22.06 | 5.02 | 35.81 | 29.68 | 8.10 |
| S.Em± | 0.39 | 2.31 | 2.85 | 1.64 | 3.21 | 3.61 | 2.20 |
| CD (P=0.05) | NS | 6.86 | 8.48 | 4.87 | 9.53 | 10.72 | 6.53 |

$T_1$: 163.2: 57.4: 37.8 N, $P_2O_5$ and $K_2O$ kg ha $^{-1}$ $T_4$: 326.4: 114.8: 75.6 N, $P_2O_5$ and $K_2O$ kg ha $^{-1}$
$T_2$: 217.6: 76.5: 50.4 N, $P_2O_5$ and $K_2O$ kg ha $^{-1}$ $T_5$: 380.8: 133.9: 88.2 N, $P_2O_5$ and $K_2O$ kg ha $^{-1}$
$T_3$: 272.0: 95.7: 63.0 N, $P_2O_5$ and $K_2O$ kg ha $^{-1}$ $T_6$: 150.0: 65.0: 65.0 N, $P_2O_5$ and $K_2O$ kg ha $^{-1}$

**Table 4: Stem girth and economics of maize as influenced by target yield approach**

| Treatment | Stem girth (cm) | | | Economics | | |
|---|---|---|---|---|---|---|
| | 30 DAS | 60 DAS | 90 DAS | Gross returns (Rs. $ha^{-1}$) | Net returns (Rs. $ha^{-1}$) | B:C |
| $T_1$-Target yield 60 q $ha^{-1}$ | 5.19 | 5.41 | 6.00 | 115727 | 83425 | 3.58 |
| $T_2$-Target yield 80 q $ha^{-1}$ | 5.29 | 5.63 | 6.20 | 130849 | 95000 | 3.65 |
| $T_3$-Target yield 100 q $ha^{-1}$ | 5.33 | 5.79 | 6.39 | 148220 | 109026 | 3.78 |
| $T_4$-Target yield 120 q $ha^{-1}$ | 5.40 | 5.94 | 6.54 | 165115 | 122675 | 3.89 |
| $T_5$-Target yield 140 q $ha^{-1}$ | 5.45 | 6.05 | 6.67 | 170590 | 125104 | 3.75 |
| $T_6$- RDF | 5.11 | 5.30 | 5.91 | 110245 | 77249 | 3.34 |
| $T_7$- Absolute control | 4.73 | 4.89 | 4.99 | 41047 | 20957 | 2.04 |
| S.Em± | 0.16 | 0.17 | 0.14 | 3733 | 3733 | 0.10 |
| CD (P=0.05) | 0.48 | 0.52 | 0.40 | 11091 | 11091 | 0.29 |

$T_1$: 163.2: 57.4: 37.8 N, $P_2O_5$ and $K_2O$ kg $ha^{-1}$ $T_4$: 326.4: 114.8: 75.6 N, $P_2O_5$ and $K_2O$ kg $ha^{-1}$

$T_2$: 217.6: 76.5: 50.4 N, $P_2O_5$ and $K_2O$ kg $ha^{-1}$ $T_5$: 380.8: 133.9: 88.2 N, $P_2O_5$ and $K_2O$ kg $ha^{-1}$

$T_3$: 272.0: 95.7: 63.0 N, $P_2O_5$ and $K_2O$ kg $ha^{-1}$ $T_6$: 150.0: 65.0: 65.0 N, $P_2O_5$ and $K_2O$ kg $ha^{-1}$

## REFERENCES


1. Biradar, A., Jayadeva, H. M., Shankarlingappa, B. C and Vishwanath, A. P., Effect of target yield approach on growth, yield and nutrient uptake at flowering of maize. *Mysore J. Agric. Sci*., **47(4):** 707-712 (2013).
2. Biradar, D. P., Aladakatti, Y. R. and Basavanneppa, M. A., Enhancing the productivity and economic returns of field crops with balanced nutrient application through site specific nutrient management approach. *Proc. Agro-Informatics and Precision Agric.*, 1-3 August, Hydrabad, India: pp. 146-151 (2012).
3. Borrel, A. K. Incoll, L. D. and Dalling, The influence of the rhtl and rht2 alleles on the deposition and use of stem reserves in wheat. *Ann. Bot*., **71:** 317-326 (1993).
4. Daikho, A., 2013. Performance of maize hybrids to varying fertilizer levels in the northern transitional zone of Karnataka. *M. Sc. (Agri.) Thesis,* Univ. Agric. Sci., Dharwad, Karnataka (India).
5. Hirpa, D. D., Hunshal, C. S., Hiremath, S. M., Awaknavar, J. S., Wali, M. C., Nadagouda, B. T and Chandrashekar, C. P., Performance of maize (*Zea mays* L.) hybrids as influenced by different levels of nitrogen, phosphorus, potassium and sulphur application. *Karnataka J. Agric. Sci*. **26(2):** 194-199 (2013).
6. Jayaprakash, T. C., Nagalikar, V. P., Pujari, B. T. and Shetty, R. A., Effect of organics and inorganics on growth and yield of maize under irrigation. *Karnataka J. Agric. Sci*., **18(3):** 798 (2006).
7. Jemal Abdulai, 2010. Response of maize (*Zea mays* L.) and chickpea (*Cicer arietinum* L.) to site specific nutrient management (SSNM) through targeted yield approach, *M. Sc. (Agri.) Thesis,* Univ. Agric. Sci., Dharwad, Karnataka (India).
8. Sarnaik, P. H. 2010. Nitrogen management in hybrid maize (*Zea mays* L.) through leaf colour chart. *M. Sc. (Agri.) Thesis*, submitted to Univ. Agric. Sci., Dharwad (India).
9. Sreelatha, D., Sivalakshmi, Y., Anuradha, M. and Rangareddy, R., Productivity and profitability of rice-maize cropping system as influenced by site specific nutrient management. *Maize J*., **1(1):** 58-60 (2012).
10. Tisdale, S. L., Nelson, W. L., Beaton, J. D. and Havling, J. L. 1995. Soil fertility and fertilizers, Fifth edition, prentice Hall of India Pvt. Ltd. New Delhi, p. 938.
11. Watson, D. J., The physiological basis for variation in yield. *Advances in Agron*., **4:** 101-145 (1952).