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Growth indices of maize as influenced by target yield based nutrient management in maize-chickpea cropping sequence

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ABSTRACT

A field experiment was conducted during 2021-22 and 2022-23 at PGI, Research Farm, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar Maharashtra (India) to evaluate the growth indices of maize as influenced by target yield based nutrient management in maize-chickpea cropping sequence. The experiment was laid out in randomized block design with four replications. The treatment consists of five nutrient management treatments such as T_1-100% RDF + FYM @ 10 t ha^{-1}, T_2- As per soil test, T_3- Target yield of 60 q ha^{-1} as per STCR equation with FYM @ 10 t ha^{-1}, T_4- Target yield of 70 q ha^{-1} as per STCR equation with FYM @ 10 t ha^{-1} and T_5 -Control. The higher growth indices *viz.,* AGR, CGR and RGR was recorded in target yield of 70 q ha^{-1} as per STCR equation with FYM @ 10 t ha^{-1}.

Key words : *maize, chickpea, chickpea, Growth, indices, yield*

Introduction

India grows maize (*Zea mays* L.), one of the most significant cereal food crops. After rice and wheat, it comes in third place among cereal crops. Because it offers the highest potential genetic output of any cereal, maize is referred to as the "Queen of Cereals" worldwide. In addition to being needed by the different sectors, maize is consumed as food and fodder. In India, over 35% of the maize produced is used for human use, 25% goes toward feeding cattle and poultry, and 15% is used in the paper and food processing industries. Around 201 million hectares are used for cultivation, and its global production is 1162 million tons, with a productivity of 5754.7 kg ha^{-1}. Since maize is a comprehensive crop, its nutritional needs cannot be satisfied solely by its natural nutrient reserves; additional nutrients can be obtained by applying fertilizer. The low yield of maize can be attributed to the uneven fertilizer application. Long-term studies indicated that soil fertility is decreased mostly due to excessive removal of nutrients and inadequate replenishment through manures and fertilizers. Several approaches have been used for fertilizer recommendation based on chemical soil test so as to attain maximum yield per unit of fertilizer use. Among the various approaches, the target yield approach has found popularity in India (Rao and Srivastava, 2000). This method not only estimates soil test based fertilizer dose but also the level

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of yield the farmer can achieve with that particular dose. It gives a real balance between applied nutrients and the available nutrients already present in the soil (Choudhary *et al.,* 2021). Hence balanced nutrition is one of the essential and necessary components of nutrient management, which plays a major role in increasing the productivity and quality of maize (Nayaka *et al.,* 2021). The present investigation aimed to evaluate the growth indices of maizeas influenced by target yield based nutrient management in maize-chickpea cropping sequence.

Material and Methods

The field experiment was carried out during 2021-22 and 2022-23 at Post Graduate Research Farm, Mahatma Phule Krishi Vidyapeeth, Rahuri to evaluate the growth indices of maize as influenced by target yield based nutrient management in maize-chickpea cropping sequence. The experiment was laid out in randomized block design during *kharif* season with four replications. The treatments comprised of five nutrient management *viz*., T_1-100% RDF + FYM @ 10 t ha^{-1}, T_2- As persoil test, T_3- Target yield of 60 q ha^{-1} as per STCR equation with FYM @ 10 t ha^{-1}, T_4- Target yield of 70 q ha^{-1} as per STCR equation with FYM @ 10 t ha^{-1} and T_5-Control. During two years of the study, Rajarshi variety of maize were used. The soil of experiment lay out low in available nitrogen, medium in available phosphorus and high in available potassium content.

Results and Discussion

Absolute growth rate (AGR)

Absolute growth rate (AGR) was varied by target yield based nutrient management treatments at all the stages of crop growth with (Table 1). The maximum absolute growth rate for dry matter was recorded in target yield of 70 q ha^{-1} as per STCR equation with FYM @ 10 t ha^{-1} (T_4) at 30-60 and 60-90 was 2.02 and 5.75 g day^{-1}plant^{-1} during first year and 2.04 and 5.78 g day^{-1}plant^{-1} during second year, respectively as compared to rest of the treatments. Lower crop growth rate for dry matter was recorded undercontrol (T_5) treatment at all the growth stages of crop during both years. Since maize plant is highly responsive to higher dose of nutrient resulted higher metabolic processes of plant and more the dry matter production. It led to enhanced vegetative growth. Less dry matter production per plant which is related with low absolute growth rate.

Crop growth rate (CGR)

Crop growth rate depends on rate of dry matter accumulation per day in a unit area. The data indicated in Table 4.1 explained that maximum crop growth rate was recorded in target yield of 70 q ha^{-1} as per STCR equation with FYM @ 10 t ha^{-1}(T_4) at 30-60 and 60-90 was 0.168 and 0.479g day^{-1}plant^{-1} during first year and 0.170 and 0.481 g day^{-1}plant^{-1} during second year, respectively as compared to rest of the treatments. Minimum crop growth rate was recorded incontrol (T_5) treatment at all the growth stages of crop during both years. Increase in crop growth rate might be due to adequate availability of nutrients attributed to better nutritional environment for plant growth at active vegetative stages as a result of enhancement in cell multiplications, cell elongation and cell expression in plant body which ultimately increased the crop growth rate. The results are in confirmity with the findings of Kumar *et al.* (2020) and Manjunath *et al.* (2021).

Table 1. Mean absolute growth rate and crop growth rate of maize as influenced periodically by different nutrient management treatments

Treatment	AGR (g day^{-1} plant^{-1})				CGR (g m^{-2} day^{-1} plant^{-1})			
	2021		2022		2021	2022	2021	2022
	30-60 DAS	60-90 DAS	30-60 DAS	60-90 DAS	30-60 DAS	60-90 DAS	30-60 DAS	60-90 DAS
T_1	1.88	4.30	1.87	4.34	0.157	0.359	0.156	0.362
T_2	1.96	4.78	1.96	4.80	0.163	0.398	0.163	0.400
T_3	2.02	5.35	2.05	5.38	0.169	0.446	0.171	0.448
T_4	2.02	5.75	2.04	5.78	0.168	0.479	0.170	0.481
T_5	1.72	1.19	1.73	1.18	0.144	0.099	0.145	0.098
GM	**1.92**	**4.27**	**1.93**	**4.29**	**0.160**	**0.356**	**0.161**	**0.358**

Table 2. Mean absolute growth rate and crop growth rate of maize as influenced periodically by different nutrient management treatments

Treatment	RGR (g day^{-1} plant^{-1})				LAI			
	2021		2022		2021	2022	2021	2022
	30-60 DAS	60-90 DAS	30-60 DAS	60-90 DAS	30-60 DAS	60-90 DAS	30-60 DAS	60-90 DAS
T_1	0.044	0.033	0.042	0.033	6.26	7.55	6.46	7.65
T_2	0.042	0.034	0.040	0.033	6.50	7.82	6.69	7.95
T_3	0.040	0.035	0.039	0.034	6.74	8.10	6.96	8.22
T_4	0.038	0.036	0.037	0.036	6.96	8.21	7.19	8.43
T_5	0.050	0.014	0.053	0.014	6.04	6.97	5.83	6.77
GM	0.043	0.030	0.042	0.030	6.50	7.73	6.62	7.80

Relative growth rate (RGR)

Relative growth rate depends on rate of dry matter accumulation per unit existing dry matter in unit time. The data presented in Table 4.2 revealed that maximum relative growth rate was observed in target yield of 70 q ha^{-1} as per STCR equation with FYM @ 10 t ha^{-1}(T_4) treatment at 30-60 and 60-90 was 0.038 and 0.036 g g^{-1} day^{-1}during first year and 0.037 and 0.036 g g^{-1} day^{-1}during second year, respectively than rest of the treatments. Minimum relative growth rate was recorded in control (T_5) at all the growth stages of crop during both years. The increase in relative growth rate is due to the integration of inorganic nutrients with organic manure which might have increased the nutrient availability in synchronization with crop nutrients demand. These results are in conformity with the findings of Kumar *et al.* (2020) and Manjunath *et al.* (2021).

Leaf area index (LAI)

Leaf area index is used to reflect the importance of plant nutrition and the potential capability of the leaf to photosynthesize. The data indicated in Table 4.2 implicited that leaf area index plant^{-1}was recorded maximum in target yield of 70 q ha^{-1} as per STCR equation with FYM @ 10 t ha^{-1}(T_4) treatment at 30-60 and 60-90 was 6.81 and 8.21 during first year and 7.19 and 8.43 during second year, respectively than rest of the treatments. Maximum leaf area index was observed in control (T_5) at all the growth stages of crop during both years. It might be due to application of balanced amount of fertilizers, adequate availability of nutrients that resulted in better formation of photosynthates which promote the metabolic activities, accelerated cell division and formation of meristematic tissues, number of functional leaves per plant increased, ultimately enhanced leaf area index. The present results were in accordance with the findings of Kumar *et al.* (2020), Manjunath *et al.* (2021) and Ramya *et al.* (2021).

Conclusion

Based on the results of present investigation and similar finding of previous researchers, it could be concluded that the fertilizer application based on STCR-Target yield equations recorded higher growth indices in maize which resulted into higher yield in maize.

Conflict of Interest None

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