JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

EFFECTS OF INTEGRATED NUTRIENT MANAGEMENT ON GROWTH, YIELD AND ECONOMICS OF HYBRID MAIZE (*ZEA MAYS L.*) COH(M) 8

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Abstract

A field study was conducted at the Experimental farm, Department of Agronomy, Faculty of Agriculture, Annamalai University, Annamalai Nagar, Tamil Nadu, India during June 2025 - September 2025 to study the effects of integrated nutrient management on growth, yield and economics of hybrid maize (*Zea mays* L.) The experiment was laid out in Randomized Block Design (RBD) comprised of twelve treatments and replicated thrice. The treatments included of recommended dose of fertilizers (RDF) along with FYM, adopting cultural method of deep ploughing and Maize Maxim. From the results, it was revealed that Deep ploughing with FYM @ 12.5 t/ha, RDF, Maize Maxim and adopting Push and Pull Strategy with intercrop Sun hemp (T_{12}) was significantly recorded the maximum growth parameters like plant height (199.72 cm), Leaf area index (6.44), yield parameters Cob length (24.60 cm), No. of grains per cob (517), grain yield (7512 kg ha^{-1}), Gross income (Rs. 1,92,908), Net income (Rs. 1,28,008) and Benefit: cost ratio (2.97)

Key words: Attributes, Deep ploughing, FYM, Maize, Maize Maxim, Inorganics

Introduction

Maize is known as "***Queen of cereals***", because of its highest genetic yield potential. In India, maize is grown in an area of 144.08 lakh hectares with production of 550.93 lakh tons and productivity of 3824 kg/ha (DA&FW, 2025). As the maize is considered as an exhaustive crop, it requires more nutrients, the fertilizer management is one of the most important factors that influence the growth and yield of maize crop (Suri *et al*., 2026).

Maize (*Zea mays* L.) has better yield response to fertilizers due to which a trend of applying heavy dose of chemical fertilizers. Though these chemical source of nutrient helps temporary increase in crop production deterioration natural resource is also another side such high input intensive cultivation on the other hand. Though organic sources of nutrients supplies different macro and micro – nutrients to crop. The optimum yield level of maize production can not be achieved by using only organic manures because of their low nutrient content, efficacy of organic sources to meet the nutrient requirement of crop is not as assured as mineral fertilizers, but the integrated use of chemical fertilizers along with various organic sources is capable to improve soil quality and higher crop productivity long term basis. Keeping this in view, the present study evaluates whether integrating soil, organic and inorganic nutrient and crop management practices can enhance maize productivity and minimize than their isolated application.

Materials and Methods

A Field study was carried out during *Kharif* season from July 2025 to October 2025. at the Experimental Farm, Department of Agronomy, Annamalai University, Annamalai Nagar, Tamil Nadu. The experimental farm is situated at 11º 24' N latitude and 79º24'E longitude and an altitude of +5.79m above mean sea level. The weather at Annamalai Nagar is moderately warm with hot summer months. During cropping period recorded maximum temperature ranges from 32.2 °C and 37.8°C with a mean of 37.0 °C while the minimum temperature ranges from 19.2 °C to 20.8 °C with a mean of 19.87°C. The relative humidity ranges from 65 to 75 percent with a mean of 68.81 percent and crop received a total rainfall of 386 mm in 21 rainy days. The soil was medium black with the initial soil fertility status of 230 kg/ha low in available nitrogen, 21.50 kg/ha medium in available phosphorous and 279 kg/ha high in available potassium.

The experiment was laid out in RBD with twelve treatments and replicated thrice. The treatments were *viz*., T_1- Control (100% RDF + FYM @ 12.5 t/ha), T_2 - Deep ploughing + FYM @ 12.5 t/ha+ RDF + Maize Maxim , T_3 - Push and Pull Strategy + FYM @ 12.5 t/ha +RDF + Maize Maxim , T_4 - Deep ploughing + FYM @ 12.5 t/ha +RDF + Maize Maxim + Cowpea, T_5 - Deep ploughing + FYM @ 12.5 t/ ha +RDF + Maize Maxim + Lablab , T_6 - Deep ploughing + FYM @ 12.5 t/ha +RDF + Maize Maxim + Sun hemp , T_7 - Push and Pull Strategy + FYM @ 12.5 t/ ha +RDF + Maize Maxim + Cowpea , T_8 - Push and Pull Strategy + FYM @ 12.5 t/ha +RDF + Maize Maxim + Lablab, T_9-Push and Pull Strategy + FYM @ 12.5 t/ ha +RDF + Maize Maxim + Sun hemp, T_{10}- Deep ploughing + FYM @ 12.5 t/ha +RDF + Maize Maxim + Push and Pull Strategy + Cowpea , T_{11}-Deep ploughing + FYM @ 12.5 t/ ha +RDF + Maize Maxim + Push and Pull Strategy + Lablab , T_{12}-Deep ploughing + FYM @ 12.5 t/ ha +RDF + Maize Maxim + Push and Pull Strategy + Sun hemp. Hybrid maize CO(H)M-8 was selected for this study and obtained from TNAU. Seeds were sown at a depth of 4-5 cm with a spacing 60 cm × 25 cm. Recommended nutrient dose of 250:75:75 kg N, P_2O_5, K_2O were applied as Urea (46% N), single super phosphate (16% P_2O_5) and muriate of potash (60% K_2O) fertilizers, to supply N, P and K nutrients, respectively. The entire dose of phosphorus and potassium were applied basally. A half dose of nitrogen was applied basally and the remaining half doses of nitrogen were applied as two splits on the 25th and 45th days after sowing. In addition, as per the treatment schedule, the prescribed quantities of the organic manures FYM @ 12.5 t/ha, were applied along with prescribed quantities of inorganic fertilizers. Maize Maxim @ 0.5 % Foliar spray was carried out at tasseling initiation and grain filling stages. Standard agronomic practices were adopted. The experiment was carried out in a randomized block design (RBD) with three replications. The statistical method used for the data analysis is two-way Anova with the software name is Statistical Package for Social Sciences (SPSS). The data on various studies recorded during the investigation were subjected to statistical scrutiny suggested by Gomez and Gomez (2010).

Results and Discussion

Physiological traits

The study revealed that the significant variation was recorded on growth parameters, viz., plant height, LAI, and dry matter production, as shown in Table 1. The application of Deep ploughing + FYM @ 12.5 t/ha + RDF + Maize Maxim + Push and Pull Strategy + Sun hemp (T_{12}) produced significantly higher growth parameters i.e., plant height and LAI (199.72 cm and 6.44 respectively) which was significantly higher over rest of the treatments. The improved crop performance under T_{12} may be attributed to the combined influence of soil, organic and inorganic nutrient and crop management practices, which together likely created favourable conditions for plant growth and physiological activity. Enhanced nutrient availability and uptake under integrated organic nutrient sources with inorganic fertilizers may have promoted greater leaf area development, chlorophyll synthesis, and photosynthetic efficiency, resulting in increased accumulation of structural carbohydrates and dry matter production. The incorporation of FYM stimulate metabolic activity by improving soil physical properties, moisture retention, microbial proliferation, and gradual nutrient release, thereby creating a favourable rhizosphere environment for sustained crop growth. Maize maxim is a crop booster with nutrients and growth regulators for maize. Increased growth parameters by application of maize maxim crop booster can be due to the combined effect of macronutrients, micronutrients and growth regulators present in the right proportion. The dry matter accumulation in the plant was attributed to higher supplementation of essential nutrients and phytohormones which results in increased specific leaf weight and improved photosynthesis. Maize maxim stimulate plant growth through multiple mechanisms, including biological nitrogen fixation, phosphate solubilization, phytohormone production and improved nutrient acquisition, which collectively contribute to enhanced crop productivity. The crop yield increased with tilling depth owing to the increasing mineralization under deeper ploughing. The mineralisation of subsoil organic carbon (SOC) would be stimulated by over-deep disturbance, where stored more than 50% of the world's SOC. (Huang *et al.,* 2023). The push and pull strategy adopted treatment is by intercropping of pest repelling or deterring crops such as Sun hemp with maize and pest attracting or pulling crop castor as a border crop around the intercropped field. The release of volatile chemicals from intercrops which helped in repelling FAW and reduced its incidence (Sivamurugan *et al*.2024). Moreover, the lowest growth parameters were measured in absolute control (T_1) plots.

Yield traits

In respect to yield traits, which were given in Table 1, showed significant variation in all the treatments. The application of Deep ploughing + FYM @ 12.5 t/ha + RDF + Maize Maxim + Push and Pull Strategy + Sun hemp (T_{12}) produced significantly higher growth parameters ie., cob length (24.60 cm), number of grains per cob (517) and grain yield (7512 kg/ha) which was significantly higher over rest of the treatments. The increase in yield under these treatments was because of favorable influence of nutrient application on the yield attributes of maize. The improvement in grain yield under treatments involving organic fertilizer FYM might be due to the improvement in soil physico-chemical properties (viz., pH, bulk density, infiltration rate and microbial biomass carbon) and optimum availability of nutrients and organic carbon which acted as the growth and yield enhancing characters of maize crop. The influence of NPK level in both of these characters mediated through increased photosynthesis efficiency and nutrient accumulation have ultimately led to production of higher biological yield under this application. Application of inorganic fertilizer would lead to an increased yield due to the readily available and mineralized nutrients present in inorganic fertilizers along with constant release of nutrients by organic fertilizers (Jeevabharathi *et al,* 2020). The balanced nutrient application of Maize maxim at the appropriate crop growth stage along with necessary growth regulators present in crop boosters resulted in the enhanced allocation of nutrients to the reproductive parts and improved grain filling. The observed results were in close conformity with findings of (Pavithran *et al.2022*). Improved yields in the deep-ploughed plots, particularly at the dry hot summer of the sampling year, which was related to reduced bulk density, increased macro aggregation and incorporation in the buried topsoil stripes, and thus increased root growth. (Burger *et al.,*2023). higher yield could be due to presence of anisole, myrcene and other natural enemies and repelling nature of intercrop due to the release of volatile compounds, which reduced FAW incidence Whereas, the lowest yield attributes were recorded in absolute control (T_1) plots.

Economics

The results on, Economic analysis of hybrid maize COH(M) 8 production showed that integrated application of nutrients increased the gross and net returns compare to inorganic nutrition. Combined application of recommended dose of Deep ploughing + FYM @ 12.5 t/ ha +RDF + Maize Maxim + Push and Pull Strategy + Sun hemp was found most remunerative and gave maximum gross income (Rs.1,92,908 /ha), net income (Rs. 1,28,008 /ha and B:C ratio (2.97). This may be due to higher grain yield and better utilization of resources at lower cost of cultivation. These results were in accordance with the findings of (Biswasi *et al.,* 2020). The negative response in net return was recorded in control (T_1) plots. This might be due to no fertilization and low productivity of the crop.

Conclusion

Based on the findings of the present investigation, it could be inferred that the adoption of Deep ploughing + FYM @ 12.5 t/ha + RDF + Maize Maxim + Push and Pull Strategy + Sun hemp (T_{12}) significantly enhancing the growth and yield attributes of hybrid maize and more remunerative over rest of the treatments. Adoption of this practice will be an agronomically sound, ecologically safe practice for small and marginal farmers of Tamil Nadu, India.

ACKNOWLEDGEMENT

The authors gratefully acknowledge the authorities of Annamalai University for providing the necessary facilities and support to successfully carry out the research trials and for enabling the completion of the research work and preparation of this manuscript.

Compliance with ethical standards

Conflict of interest: Authors do not have any conflict of interests to declare.

Ethical issues: None

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Treatment details	Growth attributes				Yield attributes			Economics			
	Plant height (cm)		LAI		Cob length (cm)	No. of Grains/ cob	Grain Yield (kg/ha)	Cost of Cultivation (Rs ha^{-1})	Gross Income (Rs ha^{-1})	Net income (Rs ha^{-1})	Benefit: cost ratio
	30 DAS	60 DAS	30 DAS	60 DAS							
T_1	44.02	135.02	1.30	2.34	9.56	140	2912	48,000	73,906	25,906	1.53
T_2	48.42	146.92	1.59	2.79	10.76	188	3896	60,400	98,880	38,880	1.63
T_3	52.11	155.02	1.89	3.18	11.99	202	4357	58,800	1,10,753	51,953	1.88
T_4	58.92	168.72	2.41	4.09	14.55	284	5513	60,510	1,40,359	79,849	2.31
T_5	54.77	163.13	2.15	3.59	13.35	241	4958	60,690	1,26,160	65,470	2.07
T_6	60.82	171.93	2.52	4.21	15.51	297	5701	60,550	1,45,271	84,721	2.39
T_7	68.74	182.11	3.10	5.01	19.21	392	6410	58,860	1,64,250	1,05,390	2.79
T_8	66.31	176.85	2.82	4.63	17.81	349	6005	59,000	1,53,167	94,167	2.59
T_9	71.24	187.02	3.39	5.43	21.23	451	6712	58,900	1,71,826	1,12,926	2.91
T_{10}	75.72	194.39	3.71	6.05	23.44	495	7210	63,010	1,84,720	1,21,710	2.93
T_{11}	73.29	189.48	3.46	5.64	22.25	463	6907	61,000	1,76,681	1,15,681	2.89
T_{12}	78.12	199.72	3.95	6.44	24.60	517	7512	64,900	1,92,908	1,28,008	2.97
S.Ed	1.17	2.41	0.11	0.17	0.55	8.10	147.1	-	-	-	-
CD (P=0.05)	2.35	4.82	0.21	0.35	1.11	16.2	294.3	-	-	-	-

DAS: Days after sowing; S.Ed - *Standard error of difference*; CD - Critical difference.