

# Effect of Nitrogen and Phosphorus Fertilizers on Growth and Yield of Quality Protein Maize (QPM)

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**Abstract:** Response of quality protein maize hybrid (HQPM-1) to various N and P levels was studied at College Farm, College of Agriculture, Rajendranagar, Hyderabad during kharif 2012. Quality protein maize was tested with four nitrogen levels (0, 120, 180 and 240 kg N ha<sup>-1</sup>) and four phosphorus levels (0, 60, 80 and 100 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup>) which was laid out in randomized block design with three replications at a spacing of 60 × 20 cm. Results showed that each incremental effect of nitrogen and phosphorus fertilizers significantly increased the plant height, LAI, dry matter production and yield (grain and stover) of HQPM-1 hybrid over control. Application of 240 kg N ha<sup>-1</sup> gave maximum plant height (212.75 cm), LAI (3.89), dry matter production (13432 kg ha<sup>-1</sup>), grain yield (6383 kg ha<sup>-1</sup>) and stover yield (7050 kg ha<sup>-1</sup>) followed by 180, 120 kg N ha<sup>-1</sup> and control. Similarly, 100 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> resulted in highest plant height (185.95 cm), LAI (3.17), dry matter production (10572 kg ha<sup>-1</sup>), grain yield (5010 kg ha<sup>-1</sup>) and stover yield (5562 kg ha<sup>-1</sup>). It is concluded that N and P should be applied at the rate of 240 kg ha<sup>-1</sup> and 100 kg ha<sup>-1</sup> for quality protein maize to realize good yields in the agro-ecological conditions of South Telangana region of A.P.

**Keywords:** Quality protein maize, Nitrogen and Phosphorus fertilizers, growth parameters, Yield

## 1. Introduction

Maize (*Zea mays*) the American Indian word for corn means literally “that which sustains life”. Maize is emerging as an important world cereal crop after wheat and rice, which is considered as “Queen of Cereals”, due to the high productiveness, easy to process, low cost than other cereals [Jaliya *et al.*, 2008], provides nutrients for humans and animals, serves as basic raw materials for production of starch, oil, alcoholic beverages, and more recently fuel [Punita, 2006]. It is a good source of carbohydrates, fat, protein and some important vitamins and minerals, but deficient in essential amino acids viz., lysine and tryptophan that reduces its biological value. The amount of these deficient amino acids has been increased by incorporating opaque-2 gene in quality protein maize (QPM) [Bisht *et al.* 2012]. Hence, the cultivation of QPM provides an opportunity to the farmers to produce nutritionally superior maize grains, where maize is a staple food and potential source of proteins in many developing countries of Latin America, Africa and Asia. At global level maize accounts for 15% proteins and 20% of calories in world food diet [Prasanna *et al.*, 2001]. The potentiality of maize manifested in the form of growth, grain yield and yield attributes is remarkably affected by various biotic and abiotic factors, of which nutrient management is prime one. Undoubtedly, being heavy feeder of nutrients and high productivity potential, maize crop requires continuous and assured nutrient supply throughout the growing period from germination to grain filling stage. Thus proper nutrient management with Nitrogen and Phosphorus fertilizers for QPM hybrid is important to realize higher yields.

Nitrogen is a component of protein, nucleic acids and other compounds essential for plant growth process [Onasanya *et al.*, 2009]. It is a major plant growth and yield determining nutrient required for maize production [Manzoor *et al.*, 1999]. Generally, phosphorus is the second crop limiting nutrient in most of the soils. Phosphorus is needed for growth, utilization of sugar and starch, photosynthesis, metabolic process which leads to higher yield potential [Ayub *et al.*, 2002]. Hence considering nutritive values and productivity of QPM, the present experiment on nutrient management on QPM was initiated.

## 2. Materials and Methods

A field experiment was conducted on Quality Protein Maize during kharif 2012, at College Farm, College of Agriculture, Rajendranagar, Hyderabad. The experiment consisted of four levels N (0, 120, 180 and 240 kg ha<sup>-1</sup>) and P (0, 60, 80 and 100 kg ha<sup>-1</sup>) with three replications in Randomized Block Design. The soil was classified as sandy loam, neutral in soil reaction (p<sup>H</sup> – 6), rich in organic carbon (0.43%), medium in available nitrogen (309 kg ha<sup>-1</sup>), phosphorus (31.23 kg ha<sup>-1</sup>) and available potassium (320 kg ha<sup>-1</sup>). The annual rainfall of the region is 532.8 mm. Quality Protein Maize hybrid (HQPM-1) was sown 9<sup>th</sup> July 2012 with a seed rate of 20 kg ha<sup>-1</sup> at a spacing of 60 × 20 cm. A uniform basal dose of potassium (80 kg ha<sup>-1</sup>) and graded levels of phosphorus was applied basally at sowing. Nitrogen in the form of urea as per levels was applied as basal (sowing time) and in splits (30 DAS, 45 DAS). Crop was harvested on Oct 18<sup>th</sup> 2012.

**Table 1:** Effect of nitrogen and phosphorus fertilizer on growth and yield of quality protein maize

Treatment	Plant height (cm)	LAI	Dry matter production (kg ha <sup>-1</sup> )	Grain yield (kg ha <sup>-1</sup> )	Stover yield (kg ha <sup>-1</sup> )
Nitrogen Levels (kg ha <sup>-1</sup> )					
0	116.04	1.33	4022	1823	2198
120	181.12	2.39	9176	4256	4920
180	202.94	3.59	11832	5585	6247
240	212.75	3.89	13432	6383	7050
SE m±	1.65	0.05	198	93	105
CD (P=0.5)	4.78	0.15	573	269	304
Phosphorus Levels (kg ha <sup>-1</sup> )					
0	170.55	2.35	8176	3798	4378
60	175.43	2.74	9616	4490	5126
80	180.90	2.94	10098	4749	5348
100	185.95	3.17	10572	5010	5562
SE m±	1.65	0.05	198	93	105
CD (P=0.5)	4.78	0.15	573	269	304
Interaction (N×P)					
SE m±	3.31	0.10	396	186	211
CD (P=0.5)	NS	NS	NS	NS	NS

### 3. Results and Discussion

The growth parameters like plant height, leaf area index and dry matter production was significantly affected by the application of nitrogen and phosphorus at different levels [Table.1]. Maize crop fertilized with 240 kg N ha<sup>-1</sup> had significantly resulted in long statured plants (212.75 cm), higher leaf area index (3.89) and dry matter production at harvest (13432 kg ha<sup>-1</sup>), compared to other nitrogen levels (180, 120 kg N ha<sup>-1</sup> and control). Application of phosphorus with 100 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> produced significantly the taller plants (185.95 cm), maximum LAI (3.17), dry matter production (10572 kg ha<sup>-1</sup>) while these growth parameters was minimum in unfertilized plots and significantly higher than other „p“ levels (60, 80 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup>). The nitrogen has beneficial effect on plant metabolism which affect physiological process of the crop and thereby increases the growth parameters [Jeet *et al.*, 2012]. Likewise effect of high phosphorus levels on growth parameters were probably due to better development of root system and nutrient absorption [Masood *et al.*, 2011].

Among the four levels of nitrogen and phosphorus tested on maize, higher dose of nitrogen i.e. 240 kg N ha<sup>-1</sup> produced significantly maximum grain yield (6383 kg ha<sup>-1</sup>) and stover yield (7050 kg ha<sup>-1</sup>) followed by 180, 120 kg N ha<sup>-1</sup> and control. Likewise the phosphorus @ 100 kg ha<sup>-1</sup> resulted in significantly superior grain yield (5010 kg ha<sup>-1</sup>) and stover yield (5562 kg ha<sup>-1</sup>) over 80, 60 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> and unfertilized maize. This significant increase in yield parameters was due to application of higher doses of N and P fertilizers which enhanced nutrients uptake by the crop, by better translocation of photosynthates from source to sink. Grain and stover yield is also higher due to higher growth and yield parameters like plant height, LAI, dry matter production, cob length and girth, number of grains cob<sup>-1</sup>, test weight etc. These results are in accordance with those obtained by Singh and Nepalia *et al.*, 2009.

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## Author Profile



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