African Journal of Basic & Applied Sciences 1 (3-4): 67-69, 2009
ISSN 2079-2034


# Effect of Phosphorus and Molybdenum on Biochemical, Yield and Yield Attributing Parameters of Indian Mustard (*Brassica juncea* L. Czern and Coss)

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**Abstract:** The oilseeds scenario in India has undergone a significant change in recent years. The oilseed production increased from mere 10.83 million tones (1985-86) to 21.54 million tones (1999-2000). Phosphorus is a fascinating plant nutrient directly related to growth and development of plants. Micronutrient helps in photosynthetic activities and proper utilization of nitrogen and phosphorus. Increasing doses of phosphorus and molybdenum leads to increase in biochemical and yield attributing parameters but not up to a significant level.

**Key words:** Indian mustard · Yield · Biochemical parameters · Oil

## INTRODUCTION

India is a paradise of oilseeds, holding a premier position in the global oilseeds scenario. Commercially rapeseed-mustard are obtained from the genus *Brassica* belonging to the family cruciferae. Brassica crops are destined to play an ever-increasing role in the supply of the world's food, feed and industrial needs in the next century. Oleochemical derived from vegetables oils used in making soaps, detergents, plastics, leather, plasticizers, surfactants, lubricants, diesel substitute and also used in pharmaceutical and in metal treatment like drilling, cutting and rolling industry. In their elegant review, Downey and Rimmer [1], suggested that the biosynthetic pathway of fatty acid chain is open for manipulation and tailor made specific oil composition meant for nitch market open up new array to opportunities and value added products.

## MATERIAL AND METHODS

The present investigation was undertaken using two varieties (Varuna and Kranti) suitable for Northern Zone of India. Agronomic characters (No. of branches, plant height, No. of siliquae per plant etc.) were recorded manually. The homogenous ground seed samples from gross produce of each plot were kept in the oven at 70°C for 5-6 hrs. for removal of moisture. After it, seed were grinded finely for extraction of oil. The conventional soxhlet technique was adopted to estimate oil content according to AOAC [2]. Then, iodine [3], Refractive index (Abbe type refractrometer), tryptophan content [4], protein content [5], methionine content [6] and allylisothiocynate [2] were estimated. Methyl esters of fatty acids were prepared by the method described in "A manual of laboratory techniques" published by N.I.N. Hyderabad (A.P.), India. It was concerned and subjected for fatty acid analysis by Gas Liquid Chromatography in Central Drug Research Institute, Lucknow.

**Experimental Design, Data Collection and Analysis:** The experimental design for testing of mean and interaction effects of biotypes was split plot design with 3 replicates. The ripe siliquae were subjected to threshing for further analysis of quality components. In each case, five competitive plants were randomly selected to record observations from each replication.

## RESULTS AND DISCUSSION

Plant height, No. of branches (primary, secondary and tertiary), No. of siliqua per plant and length of siliqua did not increased significantly with increasing doses of

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Table 1: Effect of phosphorus and molybdenum on agronomical and Biochemical characters of Indian mustard

| Varieties | Plant height (cm) | Primary branches | Secondary branches | Tertiary branches | No. of siliquae/ plant | Length of siliqua | No. of seed/ siliqua | 1000-seed weight | Yield (q/ha) | Oil content | Protein content | Iodine value | Refractive index | Methionine content (g/16g) | Tryptophan content (g/16g) | Allylisothiocynate content (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Varuna | 156.87 | 8.48 | 12.60 | 1.11 | 145.94 | 4.49 | 11.06 | 4.46 | 22.56 | 39.12 | 27.56 | 108.21 | 1.4640 | 1.129 | 0.850 | 0.329 |
| Kranti | 155.78 | 7.22 | 11.00 | 0.88 | 142.89 | 4.42 | 10.19 | 3.38 | 17.80 | 41.23 | 28.29 | 105.62 | 1.4390 | 1.037 | 0.902 | 0.343 |
| CD at 1% | NS | NS | NS | NS | NS | NS | 0.75 | 0.40 | 5.62 | 0.77 | NS | NS | NS | NS | NS | NS |
| Phosphorus | | | | | | | | | | | | | | | | |
| 0 kg/ha | 150.92 | 6.50 | 10.58 | 0.25 | 128.33 | 4.31 | 10.25 | 4.22 | 22.28 | 38.54 | 26.46 | 103.23 | 1.4614 | 0.858 | 0.721 | 0.362 |
| 30 kg/ha | 156.00 | 7.22 | 12.00 | 0.75 | 139.17 | 4.49 | 10.79 | 4.36 | 23.67 | 41.47 | 27.89 | 103.46 | 1.46165 | 1.043 | 0.878 | 0.342 |
| 60 kg/ha | 162.08 | 7.98 | 12.58 | 1.20 | 159.67 | 4.56 | 11.34 | 4.43 | 24.60 | 41.69 | 29.41 | 104.20 | 1.4637 | 1.364 | 1.195 | 0.322 |
| CD at 1% | NS | NS | NS | NS | NS | NS | 0.53 | NS | NS | 0.81 | NS | NS | NS | NS | NS | NS |
| Molybdenum | | | | | | | | | | | | | | | | |
| 0 kg/ha | 152.70 | 6.59 | 11.20 | 0.50 | 137.83 | 4.34 | 9.43 | 4.00 | 15.60 | 39.42 | 27.14 | 105.7 | 1.4614 | 1.037 | 0.811 | 0.347 |
| 2 kg/ha | 156.00 | 7.60 | 11.92 | 1.00 | 146.33 | 4.55 | 9.91 | 4.20 | 16.53 | 40.96 | 18.16 | 106.00 | 1.4621 | 1.107 | 0.978 | 0.344 |
| 4 kg/ha | 158.29 | 8.23 | 12.25 | 1.17 | 148.83 | 4.63 | 10.12 | 4.32 | 17.96 | 41.32 | 18.45 | 106.68 | 1.1632 | 1.121 | 1.006 | 0.345 |
| CD at 1% | NS | NS | NS | NS | NS | NS | NS | NS | NS | 1.14 | NS | NS | NS | NS | NS | NS |

Interaction effect between phosphorus and molybdenum was found to be non-significant

Table 2: Effect of phosphorus and molybdenum on fatty acid composition of Indian mustard

| Treatment | Palmitic acid | Oleic acid | Linoleic acid | Lenoleinic acid | Eicosenoic acid | Erucic acid | Unidentified acid |
|---|---|---|---|---|---|---|---|
| Varieties | | | | | | | |
| Varuna | 3.98 | 13.46 | 15.11 | 13.54 | 6.30 | 47.29 | 0.32 |
| Kranti | 3.82 | 13.21 | 14.97 | 13.41 | 6.45 | 48.00 | 0.14 |
| CD at 1% | 0.10 | NS | NS | NS | NS | 0.70 | - |
| Phosphorus | | | | | | | |
| 0 kg/ha | 4.10 | 12.70 | 14.00 | 15.00 | 5.44 | 48.45 | 0.31 |
| 30 kg/ha | 4.00 | 12.12 | 14.73 | 15.25 | 5.40 | 48.22 | 0.28 |
| 60 kg/ha | 3.11 | 12.30 | 13.80 | 16.63 | 5.38 | 48.19 | 0.20 |
| CD at 1% | 0.08 | NS | NS | NS | NS | NS | NS |
| Molybdenum | | | | | | | |
| 0 kg/ha | 4.02 | 13.25 | 14.21 | 14.33 | 5.88 | 48.23 | 0.18 |
| 2 kg/ha | 3.96 | 13.21 | 14.65 | 15.68 | 4.84 | 47.72 | 0.21 |
| 4 kg/ha | 3.93 | 13.33 | 14.90 | 16.21 | 4.32 | 47.02 | 0.30 |
| CD at 1% | NS | NS | 0.30 | 0.83 | NS | 0.60 | - |

Interaction effect between phosphorus and molybdenum was found to be non-significant

phosphorus and molybdenum (Table 1). A slight increase in plant height was probably due to increased efficiency of metabolism due to P and Mo supply and formation of structural carbohydrates [7]. Phosphorus uptake leads to increased net $CO_2$ fixations with increased rate of photosynthesis and thereby more photosynthates to develop more No. of pods per plants [8]. No. of seed per siliqua ranged from 9.43 to 11.34, maximum with phosphorus application @ 60 kg/ha and minimum without application of molybdenum. Phosphorus leads to synthesis and deposition of seeds reserves (starch, lipid, protein and phytin) that ultimately produce higher No. of seeds per siliqua [9]. Variety Varuna was found to be superior with respect to yield (22.56 q/ha) at 1% level of significance. Biochemical parameters were not differed significantly except oil content that varied between 38.54 per cent to 41.69 per cent (Table 1). Oil content was found to be maximum with phosphorus application @ 60 kg/ha and minimum without phosphorus. A slight increase in protein content may be due to increased synthesis of pre-existing as well as new set of proteins [10]. Mean values of palmitic, oleic, linoleic, linolenic, eicosenoic and erucic acid from 3.41-4.10%, 12.12-13.46%, 13.80-15.11%, 13.41-16.63%, 5.38-6.45% and 47.02-48.45% respectively (Table 2). Among all fatty acids erucic acid was found to be maximum (48.45%) without application of phosphorus, Whereas, palmitic acid was found to be minimum (3.11%) in case of phosphorus @ 60 kg/ha. Variety Kranti differed from Varuna for erucic acid content at 5% level of significance. Thus, it can be concluded that Varuna was found to be more efficient in terms of phosphorus and molybdenum application as compare to Kranti, whereas, higher erucic acid content in Kranti make it more suitable for industrial purpose.

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