

## Sulphur

- **Function** : Sulphur is a constituent of amino acids in plant proteins and is involved in energy-producing processes in plants. It is responsible for many flavour and odour compounds in plants. Formation of chlorophyll and production of proteins. Synthesis of oils in oilseeds. Activation of enzymes.
- **Deficiency symptoms** : Young leaves are light green with lighter colour veins. Yellowing of the entire leaf including veins, usually starting with the younger leaves and stunted growth. Leaf tips may yellow and curl downward. Leaves show paling that starts from margins and spreads inwards and become yellow and/or develop a purplish pigmentation. The lamina of young leaves curls inwards and becomes scorched and withered. Symptoms spread from young to older leaves.
- **Corrective measures** : Apply elemental sulphur along with irrigation. Foliar spray of 0.1% thiourea.
- **Sources** : Single Super Phosphate (16%), gypsum (18.6%) and elemental sulphur (100%).



**Sulphur Deficiency Symptoms**

## Zinc

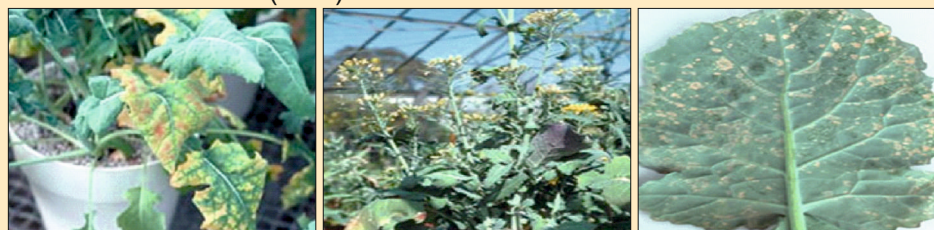
- **Function** : It is significant role in plant metabolism. Helps form growth hormone (auxin) responsible for growth of plant. It's useful for reproduction and also helps in pod development.
- **Deficiency symptoms** : Growth suppression, reduced internode length, resetting. New leaves are thick and small. Intervinal chlorosis on young leaves spotted between veins and dis-coloured veins.
- **Corrective measures** : Spray of 0.5% Zinc Sulphate solution on standing mustard crop after 45 days of sowing.
- **Sources** : Zinc Sulphate (36%) and Zinc oxide (78%).



**Zinc Deficiency Symptoms**

## Boron

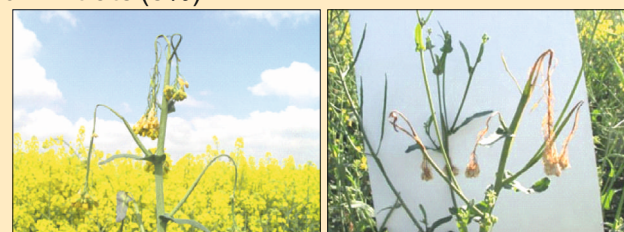
- **Function** : Affects water absorption by roots. Translocation of sugars made by photosynthesis.
- **Deficiency symptoms** : Upper parts of the plant dead due to deficiency of boron and pods of upper parts do not develop and fill with grain. Small leaves start to grow from nearby the dead parts and plant looks like bushy. Short thick stem tips, distorted shoot growth. Young leaves of terminal buds are light green at base. Leaves become twisted and die. Limited budding / podding and bud / pod break.
- **Corrective Measures** : Spray of 0.2% Borax solution on standing mustard crop 2 times at weekly intervals.
- **Sources** : Borax (11%).



**Boron Deficiency Symptoms**

## Calcium

- **Function** : Calcium is essential for root health, growth of new roots and root hairs and the development of leaves.
- **Deficiency symptoms** : Small developing leaves. Wrinkled older leaves and dead stem tips. Young leaves and fruit display calcium deficiencies first. Yellow brown spots surrounded by a sharp brown outline edge.
- **Corrective measures** : Calcium deficiency can sometimes be rectified by adding agricultural lime to acid soils, aiming at a pH of 6.5, unless the subject plants specifically prefer acidic soil. Organic matter should be added to the soil to improve its moisture-retaining capacity. However, because of the nature of the disorder (i.e. poor transport of calcium to low transpiring tissues), the problem cannot generally be cured by the addition of calcium to the roots. In some species, the problem can be reduced by prophylactic spraying with calcium chloride of tissues at risk. Plant damage is difficult to reverse, so corrective action should be taken immediately, supplemental applications of calcium nitrate at 200 ppm nitrogen, for example. Soil pH should be tested, and corrected if needed, because calcium deficiency is often associated with low pH.
- **Sources** : Lime (32%), Gypsum (29.2%) and Single Super Phosphate (19.5%) (Calcium Nitrate (19.4%) and Bone meal (23%), Calcium Ammonium Nitrate (8%).



**Calcium Deficiency Symptoms**

Author : **Drs. Ashok Kumar Sharma, Harvir Singh and P.K. Rai**  
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To more information contact us:

Director, ICAR-Directorate of Rapeseed-Mustard Research  
Sewar, Bharatpur-321 303 (Rajasthan), India

Phone: + 91-5644-260379, 260495 Fax: +91-5644-260565

e-mail: director.drmr@gmail.com Web: <http://www.drmr.res.in>



Premier # 9783855551



# Integrated Nutrient Management of Rapeseed-Mustard in Assam



**ICAR-DIRECTORATE OF RAPESEED-MUSTARD RESEARCH**

(Indian Council of Agricultural Research)

Sewar, Bharatpur 321 303 (Rajasthan) India

(An ISO 9001:2008 Certified Organization)



## Integrated Nutrient Management of Rapeseed–Mustard in Assam

Rapeseed-mustard is an energy rich oilseed crop which requires adequate quantity of nutrients. The crop is capable of removing large amount of nutrients depending on seed yield biomass production. If these crops are grown in energy starved conditions, the productivity of the crop is severely compromised. Therefore, the role of balanced and judicious fertilizer application attains importance in enhancing the level of productivity in rapeseed-mustard. It is estimated that 64.5 kg N, 20.6 kg P<sub>2</sub>O<sub>5</sub>, 53.4 K<sub>2</sub>O, 16 kg S, 56.5 kg Ca, 9.5 kg Mg, 0.068 kg Zn, 0.63 kg Fe, 0.2 kg Mn and 0.02 kg Cu are removed in producing one tonne of mustard seed. The requirement of fertilizer varies with the soil type, status of irrigation and species being grown. For example, in coarse textured soils, at high yield levels and where leaching is major concern, availability of potash (K) becomes critical. Similarly, the level of Iron (Fe) assumes importance in the alkaline-calcareous soils. Keeping in view, the diversity in the nature of soil, cropping sequence and agro-climatic conditions, the application of fertilizers should be done based on regular soil testing which can help in determining the exact fertilizer dosage required. Fertilizer recommendations must be modified based on soil test value for attaining better nutrient use efficiency and for minimizing the cost of fertilizers. The general recommendation of fertilizers for Assam is as follows :

For all zones of Assam, fertilizer dose of 80:40:30 kg NPK/ha is recommended for higher yield of rapeseed-mustard. In North Bank Plain Zone, a fertilizer dose of 60:40:40 kg NPK/ha under irrigated condition, while 40:35:15 NPK/ha under rainfed condition is recommended. In Central Brahmaputra Valley Zone, a fertilizer dose of 40:35:15 NPK/ha under rainfed condition is recommended. These recommendations are general in nature and the actual fertilizer requirement may vary depending upon the soil test values and cropping systems. Along with the right quantity of fertilizers the timing of fertilizer application is also important for the crop.

**The following aspects should be kept in mind while deciding the dose and timing of fertilizer application.**

- Rapeseed-mustard have been found to respond well to the application of borax in some agro-climatic zones of Assam. Use Borax@ 10 kg/ha for North Bank Plain and 5-10 kg/ha for Upper Brahmaputra Valley zone and 7.5 kg/ha for Central Brahmaputra Valley Zone in addition to recommended dose of fertilizers.
- Full dose of phosphorous (P<sub>2</sub>O<sub>5</sub>) is recommended as basal application at the time of sowing of irrigated crop.
- If the soil test values indicate deficiency of potash (K<sub>2</sub>O), apply the full dose of potash at the time of sowing under irrigated condition.
- Half of the recommended dose of N should be applied as basal at the time of sowing preferably through drilling at dose of an least 5.0 cm below the seed for proper absorption. The remaining half should be applied by the top dressing at the time of irrigation application.
- If SSP is not used as source of P, sulphur @ 20 kg/ha in the form of gypsum (133 kg/ha) should be used.
- NPK may be supplied in the form of mixed fertilizers. Nutrient requirements are to be adjusted according to contents in fertilizers.
- Bio-fertilizers can play an important role in improving the nutrient supply for the rapeseed-mustard crop and thereby enhancing the seed yield. The nitrogen fixing bacteria (azotobacter), phosphate solubilizing

bacteria (PSB) and mycorrhizae are the most commonly used bio-fertilizers which are recommended for rapeseed-mustard. Use of azotobacter can reduce the nitrogen requirement up to 25-30 kg/ha provided bacterial strain is efficient and soil is rich in organic matter. The PSB and mycorrhizae are important to increase P uptake and dry matter yield at lower level of applied phosphorous. Apply 75% N and P when seeds are inoculated with Azotobacter @ 50 g/kg seed and PSB @ 50 g/kg seed.

- Application of FYM or compost @ 2-3 t/ha is beneficial for the crop.
- Application of lime : CaCo<sub>3</sub> in the form of dolomitic lime @ 500 kg/ha should be applied 15 days before seeding and incorporate in the soil in area where multiple cropping dose of fertilizers.
- Foliar spray of urea : Two foliar applications of 1% urea at flowering and pod filling stages along with basal application of recommended fertilizer dose, i.e. 60 kg N, 30 kg P<sub>2</sub>O<sub>5</sub> and 30 kg K<sub>2</sub>O/ha.

### Function, deficiency symptoms, corrective measures and sources of important nutrients for Rapeseed-Mustard

#### Nitrogen

- **Function :** It is necessary to develop cell protein and chlorophyll and promotes growth of stems and leaves, gives dark green colour and improves foliage quality.
- **Deficiency symptoms :** An older leaf becomes light green yellow in colour. In acute shortage, the leaves may become chlorotic associated with purple colouration and older leaves may wither. The plants have stunted growth with thin and short stems having practically no branches.
- **Corrective measures :** Apply urea along with irrigation. Foliar spray of 1% urea twice at weekly interval on standing mustard crop.
- **Sources :** Urea (46%), Ammonium Sulphate (20%), Ammonium Nitrate (33.5%), DAP (18%), Potassium Nitrate (13%), Organic products farm yard manure (FYM-0.5% N), cotton seed meal (6.4%), mustard cake (5.2%) fish meal (4%).



Nitrogen Deficiency Symptoms

#### Phosphorus

- **Function :** Stimulates early formation and growth of roots. Provide fast and vigorous growth and speed maturity. Stimulates flowering and seed development. It is necessary for the enzyme action of many plant processes.

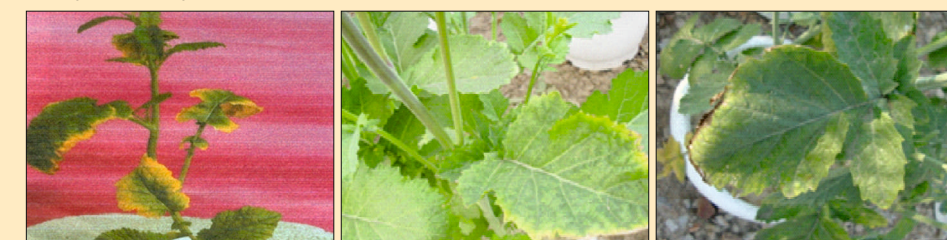
- **Deficiency symptoms :** Stunted growth, inter veinal chlorosis of third leaf from bottom, chlorosis advance to fourth leaf. Dark bluish green colouration of leaves accompanied by purplish tinges. The stem becomes bluish green having purple or reddish green. Under severe deficiency, marginal necrosis of leaves or premature defoliation of older leaves may take place.
- **Corrective measures :** Foliar spray of 2% soluble P fertilizer on standing crop. Apply phosphate solubilising micro-organism along with FYM.
- **Sources :** DAP (46%), SSP (16%).



Phosphorus Deficiency Symptoms

#### Potassium

- **Function :** Increases vigour and disease resistance of plants. Helps to form and move starches, sugars and oils in plants. Improve fruit quality.
- **Deficiency symptoms :** Chlorosis may cause yellowing of leaves lead to shedding and defoliation of the leaves. The older leaves show scorching or firing along leaf margins followed by patches of necrosis. Stunted growth lead to slow growth or poor developed roots and stems.
- **Corrective measures :** Foliar spray of 1% Potassium Sulphate on standing mustard crop. For the subsequent crop apply 25% extra of recommended potassium dose.
- **Sources :** Muriate of Potash (58-60%) and Potassium Sulphate (48-50%).



Potassium Deficiency Symptoms