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Package of Practices of Rapeseed and Mustard (*Brassica Juncea*)

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Abstract
India is the 4th largest oilseed economy in the world. Among the seven edible oilseeds cultivated in India, rapeseed-mustard contributes 28.6% in the total oilseeds production in the India's oilseed economy. The mustard growing areas in India are facing the vast diversity in the agro climatic conditions and different species of rapeseed-mustard are grown in some or other part of the country. This results in a big gap between requirement and production of mustard in India. Therefore site-specific nutrient management through soil-test recommendation based should be adopted to improve upon the existing yield levels obtained at farmers field. Effective management of natural resources, integrated approach to plant-water, nutrient and pest management and extension of rapeseed-mustard cultivation to newer areas under different cropping systems will play a key role in further increasing and stabilizing the productivity and production of rapeseed-mustard. In this article we study about the advances in proper land and seedbed preparation, optimum seed and sowing, planting technique, crop geometry, plant canopy, appropriate cropping system, integrated nutrient management.

Introduction
The Indian agriculture is considered as backbone of Indian economy. The agricultural sector is the largest employer in and employed 49% of its total workforce and contributes share of its GDP (15-17%). A large number of important industries like jute, textiles, edible oils, tobacco, sugar, etc. receive the raw materials produced by agriculture sectors. Oilseed crops are high paying crops in the dry regions. Mustard seed is the second most important oil seed crop in India after soybean. Rapeseed-mustard is a multiple use crop. Besides, its oil value, its seeds are also used as condiments in preparation of pickles and flavouring curries and vegetables. Oil and fat play a significant role in the human dietary system as well as the economy of the people. The oil is utilized for human consumption throughout India in cooking & frying. Rajasthan is the largest rapeseed-mustard growing state and alone contributes 43% of the total mustard seed production in India, mustard seed is mainly grown in North West parts of India. Rajasthan and Uttar Pradesh are the major producing States in the country. The production in Rajasthan is highly depend on monsoon. Two species of Rapeseed and mustard are Brassica juncea and B. Campestris. The oil content varies from 37 to 49%.

Climatic requirements: Mustard is a crop of temperate climates, but can also be cultivated at higher elevations in the tropics. Crop requires about 18-25ºC temperature, low humidity, practically no rains especially at the time of flowering. Require cool and dry weather and a fair supply of soil moisture during the growing period and a dry clear weather at the time of maturity.

Soil: For mustard sandy loam to clay loam soils are good but thrive best on light loam soils. Do not tolerate water logging conditions or heavy soils Soil having neutral pH is ideal for their proper growth and development. oils with an electrical conductivity (EC) of >4 dS/m and exchangeable sodium percentage (ESP) > 15% are not suitable. Soils with pH <5.0 and >9.0 are not suitable for these crops. Soils having pH 6.0-7.5 is ideal for their proper growth and development.

Land preparation: One deep ploughing with MB plough followed by 2-3 ploughing with harrow cultivator or desi plough and thereafter planking is done. Mustard requires a fine, firm, moist seed-bed so that adequate moisture is assured for germinating seeds and young seedlings. One pre sowing irrigation is needed if moisture is not sufficient at the time of sowing otherwise not required.

Sowing Time: Before the sowing of mustard, Seed treatment is a useful practice for healthy plant growth. Seed priming through controlled hydration and dehydration enhances early germination of mustard seed in less time, even in compacted soil. The soaking of mustard seeds in 0.025% aqueous pyridoxine hydrochloride solution for 4 hours improved germination. 1 Kg seed with 2.5 gms Thirum / vitavax power. Mustard should be shown First week of October to 2nd week of November. A seed rate of 5-6 kg/ha is sown in rows of 30-40 cm and plant to plant distance of 10-15 cm apart.

Variety: Pusa Bold, Pusa Mahak, RNG-48, Vardon, varuna, Krati, Rohini, Laxmi, Ashirwad, RH-30, Vasundara, basanti, NRC-HB-506, NRC-HB-101, Pusa jai kisan (Bio-902).

Cultural practices: Thinning should be done 25-30 days after sowing to maintain proper plant to plant distance according to the recommendations. Further one hoeing is done to promote plant growth.

Manures and Fertilizers: Rape seed and mustard respond well both to organic and inorganic manures. If available, apply 10- 15 tons of farm yard manure or compost at the time of field preparation. These crops show good response to chemical fertilizers. For good harvest, apply 40-60 kg nitrogen, 30 kg P2O5 and 20 kg K2O per hectare. The quantity of phosphorous and potash should be based on soil test recommendations. Split application of nitrogen is recommended. Under irrigated conditions half of the nitrogen and full dose of phosphorous and potash should be applied as basal dose. The remaining half of the nitrogen should be applied at the time of first irrigation. Rape seed and mustard have higher requirement for sulphur, therefore, nitrogen should preferably be applied through ammonium sulphate and phosphorous from single Superphosphate.

Water management: Rape seed and mustard are usually raised as rainfed on the conserved moisture from monsoon rains. Good yields can be achieved if the fields are bunded and leveled before the monsoon and ploughed two to three times during the monsoon season, bulky organic manures are applied in soil to improve moisture storage capacity of soil and evaporation losses of moisture are minimized by the use of inter-cultivation or mulching on the soil surface. Rape seed and mustard respond to irrigation as well. Application of even a small quantity of water has shown very encouraging results in these crops. Two irrigations at pre-bloom (30 DAS) and pod filling stages (60-65 DAS) are beneficial.

Weed control: Most common weeds of mustard crop are Chenopodium album (bathua), Lathyrus spp. (chatrimatri), Melilotus indica (senji), Cirsium arvense (kateli), Cyperus rotundus (motha) and Fumaria parviflora (gajri). Initial 45-60 days after sowing is critical period of crop weed competition. Uncontrolled weeds in these crops may cause 20-70% reduction in yield. Weeding should be done soon after thinning. This, besides creating soil mulch and reducing moisture losses, helps in better growth and proper development of crop plants. Under rain fed conditions, one hand weeding 25 DAS, while under irrigated conditions, 2 hand weedings 25 and 40 DAS are necessary for effective weed control. Pre-plant incorporation of fluchloralin @ 1.00 kg/ha or pre-emergence application of

pendimethalin @ 1.00 kg/ha are quite effective in controlling weeds. If the weeds emerge after planting, isoproturon @ 0.75 kg/ha may be sprayed 30 days after sowing. Application of nitrofen @ 1.0 to 1.5 kg/ha in 800-1000 liters of water as pre-emergence spray is also found effective to control the weeds.

Diseases:

Alternaria Blight- caused by Alternaria brassicae. The pathogen perpetuates through seed and affected plant portion (refuse) in the soil. Characterized by the appearance of concentric black spots on leaves, stem and pods. Such pods contain shriveled, undersized seeds.

Control Measures: Use healthy seeds. Spray Duter or Difolatan or Dithane M-45 at the rate of 2 kg in 1000l/ha 10 days interval as soon as the symptoms starts. Collect and burn the affected plant portions after the harvest of the crop.

Downy Mildew: caused by a fungus, Peronospora brassicae, yellow, irregular spots appear on the upper surface of the leaves and white growth is visible on the under surface opposite to spots. If the attack is severe, inflorescence is also affected. The affected inflorescence is malformed, twisted and covered with a white powder. No pods are produced on such inflorescence.

Control Measures: Use healthy seeds. Spray the crop with 0.2% Zineb or 0.1% Karathane as soon as the symptoms are noticed and repeat the spray 2-3 times at 10 days interval.

White Blister: caused by the fungus, Albugo candida. The disease is characterized by white raised blisters on leaves, stem, petiole and floral parts which burst and liberate a white powder. Flowers get malformed and become sterile.

Control Measures: Use healthy seeds for sowing. Spray the crop with 0.2% Zineb or Difolatan as soon as the symptoms are noticed and repeat the spray if needed at 10 days interval. Keep the field free from weeds.

Insects Pests:

These crops are subjected to the attack of insect pests' right from the seedling stage to the pod formation stage. The major insect pests are as follows:

Mustard Sawfly: Most important seedling pest where the adult fly is orange coloured with black head. The larvae feed on the leaves of rape seed and mustard making holes. Sometimes they eat up entire lamina of leaf leaving behind the midribs.

Control Measures: Dusting with 5 or 10% BHC at the rate of 20-25 kg per hectare controls the pest effectively.

Mustard Aphid: Both nymph and adult suck the sap of the tender leaves, twigs, stem, inflorescence and pods by means of piercing and sucking type of mouth parts. The aphids are green small insects about 2 mm in size. The affected leaves usually curl and in case of severe infestation the plant wilt and dry. Due to the attack on the inflorescence, the pod formation is adversely affected. The aphids also secrete 'honey dew' on which black mould develops which adversely affects the normal physiological activities of the plants.

Control Measures: As the cold and cloudy weather favours the pest multiplication, sowing the crop earlier than the normal sowing time escape the pest attack. Spraying of crop with Dimecron 100 at the rate of 250 millilitre per hectare or Metasystox 25 EC at the rate of one litre per hectare or Rogor 30 EC@1L/ha in 1000 litres of water.

Painted Bug of Mustard: Both the nymph and adult suck the sap of leaves and tender stems resulting in poor growth and pale yellow colour of the leaves. In a later stage, the insects suck the sap of the pods with the result both quantity and quality of seed is adversely affected.

Control Measures: The nymphs can be very effectively controlled with 5 % BHC dust at the rate of 20-25 kg /ha. Use of systemic insecticides like Dimecron, Rogor or Metasystox has been found very effective to control both nymphs and adults.

Cabbage Butterfly: The full grown larvae of this pest are 3 to 4 cm in length with bright yellowish-green colour and small hairs on the dorsal side. The larvae of this pest feed voraciously on the leaves, branches and pods of the crop.
Control Measures: Hand picking and killing of the caterpillars. Spraying with Malathion 50 EC at the rate of 1 L/ha controls the pest.
Bihar Hairy Caterpillar: The newly hatched caterpillars remain in clusters on the lower surface of the leaves and feed on the epidermis. If the attack occurs at the green pod stage, the entire green tissues of the pods are eaten up resulting in pre heavy loss to the crop.
Control Measures: Clipping and destruction of eggs should be followed. BHC 10% dust at the rate of 20 kg Malathion 50 EC, Thiodan 35 EC or Fenitrothion 50 EC at the rate of 1 hac.
Harvesting and Threshing: As soon as the pods turn yellowish-brown, harvest the crop. The crop is liable to shattering, hence it should be harvested just before the pods open in order to avoid losses. The harvested crop should be stacked in threshing floor for five to six days before threshing. Threshing is very easy with the help of sticks. The pods easily shatter and give away seeds. The threshed seed is separated from the husk with the help of slow moving natural air current. Cleaned seed must be dried in the sun for four to five days or till the moisture content comes down to 8 percent.
Yield: With the use of improved varieties, agronomical and plant protection techniques, the farmers may expect to harvest per hectare 14-20 quintals of seed of rape seed and 20-25 quintals of mustard.