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Response of potassium, molybdenum application on growth and yield of mustard (*Brassica campestris*)

Anjni Mastkar* and Pawan Sirothiya
Department of Natural Resource Management, Faculty of Agriculture, Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot, Satna – 485780 (M.P.) India.
***e-mail of corresponding author: kailashento@gmail.com**

ABSTRACT
A field experiment was conducted at Research Farm Rajola of Mahatma Gandhi Chitrakoot Gramodaya Vishwavidhyalaya, Chitrakoot, Satna (M. P.) during rabi season of 2015-16 with the objective to study the effect of Potash and Molybdenum for growth, yield and interaction effect of Potash x Molybdenum on crop character of Mustard. Three level of Potash (0, 20 and 30 kg ha^{1}) and three level of Molybdenum (0, 1 ppm and 2 ppm). Growth parameter viz., plant height, Nomber of leaves and root length plant^{1}, yield attributes viz. number of siliqua plant^{1}, number of seeds siliqua^{1}, and grain test weight were obtained significantly increased due to increasing levels of potash and nomber of spray of Molybdenum. Their interaction was also significant. The yield noted 870.87 to 1444.08 kg ha^{1} under different treatments combination of potash and molybdenum.
Key words **:** Mustard, Potash, Molybdenum Yield etc.

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INTRODUCTION

The importance of oilseeds in Indian economy is well documented and there is need to raise the oilseed production to bridge the large gap between the demand and supply of edible oils. Rapeseed-mustard shares about 28 % of total oilseed production in India, with area of 5745.52 thousand ha, production of 6796.72 thousand million tonnes and productivity 1183 kg ha^{1} (Source Ministry of agriculture, Govt India, 2015-16). Madhya pradesh is the fourth major mustard producing state in India followed by Gujrat and West bengal, with a share of nearly 11 percent to the country's total mustard production. Among various oilseeds cultivated in MP, Mustard is the second major oilseed crop, after soybean. Mustard covers nearly 5.5 percent of net sown area in state. In Madhya Prdesh area of 857.66 thousand ha, production 1239 thousand tonnes and productivity 1445 kg ha^{1} under mustard crop (commodities control bureau,2015-16). Rapeseed –mustard seed is mainly used for extraction of oil. Seed meal obtained after oil extraction from the seed is used as an animal feed. It is a rich source of good quality proteins and can be utilized for production of value-added products like protein concentrate, baby food and biscuits after some processing.

Mustard can be cultivated in a variety of soils but a fertile soil with a clay laom texture is best for producing higher yields. As the yield and yield components have increased significantly by an elevation in different levels of Potassium (Amanullah *et al*. 2011). Addition of NPK fertilizers increase the crop yield as well as nutritional quality generally, for example fertilizers nitrogen and potassium increased oil concentration in oil seed crops (Zhao et al., 2008).

The total molybdenum content of the soil is relatively low copared to other micronutrients with values between 0.3 and 5 ppm. Low Mo contents are found on acid sandy soils and in areas of high rainfall (Bergmann, 1992). Although oilseed rape is of medium sensitivity to Mo deficiency, the deficiency is rarely observed in rape crops. However, soil pH has a considerable influence on the availability of molybdenum to plants (Falke et al., 1988). In contract to most other micronutrients, Mo availability increases with rising pH of the soil. High fertilizer rates of sulphur may induce Mo deficiency by direct uptake competition of molybdate and sulphate ions. This may be of importance on sulphur deficient soils.

Under unfavorable conditions for molybdenum uptake, high sulphur application rates may lead to Mo deficiency and yield responses to Mo fertilization can be expected (Schnug and Haneklaus, 1990).

MATERIALS AND METHODS

The field experimental was conducted during 2015-16 at Agriculture Farm of Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot, Satna (M.P.). The experiment consisted of nine treatment combinations of three Potash levels (0, 20 and 30 kg ha^{1}) and three levels of Mo application (0, 1 and 2 ppm/ha) which were tested in a RBD with three replications. Mustard was sown on 05 Nov. 2015 and harvested on 10 Feb2016. The sowing was done at 22 cm apart with seed rate of 6.0 kg ha^{1}. Thinning was done at 20 days after sowing to keep the plant to plant spacing of 7 cm. In order to control weeds, Two hand weeding were done uniformly at 20 DAS (Days after sowing). Economic analysis of data for all the treatment ware worked out on the basis of the prevailing cost of operations, input and market price of the produce. All the observations were taken as per standard procedure. The results of experimentation showed same trend and hence the data of were pooled and analysed using standard analysis of variance.

RESULTS AND DISCUSSION

Growth and yield attributes characters:

Growth characters viz. Plant height, number of leaves and root length^{1} plant was observed with application of 30 kg ha^{1} potash and two spray of Mo (1 ppm). It is clear from the results that the increasing level of potash up to 30 kg ha^{1} increased the number of leaves plant^{1} significantly at 30, 60, 90 DAS (Days after sowing) at harvest stage. Maximum number of leaves plant^{1} was observed with the application of potash 30 kg ha^{1} which was significantly higher to 0 and 20 kg ha^{1}. The yield attributes viz., Number of siliqua plant^{1}, seeds siliqua^{1} and 1000 seed weight increased due to increasing levels of potash and number of spray of molybdenum. Application of 30 kg ha^{1} potash showed the best results in different yield component, the effect of 20 kg ha^{1} potash was found at par. On the other hand, spray of molybdenum increased all the yield component of mustard over control. The maximum number of siliqua plant^{1}, seeds siliqua^{1} and 1000 seed weight was produced by 30 kg ha^{1} which was significantly higher over 0 and 20 kg ha^{1} but statistically at par with 30 kg ha^{1}. The probable reason may be that adequate supply of all the nutrient, particularly potash which resulted in greater accumulation of carbohydrates, amino acids and their translocation to the production organs, which, inturn improved all the growth and yield attributing characters. In general, it was observed that the significant increase in yield attributes resulted due to higher levels of potash which applied with recommended dose of nitrogen, phosphorus and potassium. It due to the vigorous vegetative growth of the crop under the higher level of fertility, which resulted in adequate supply of photosynthetic in the formation of branches, siliqua and development of seed (Tiwari et al. 2012). Increases in siliqua per plant and seed per siliqua, were higher under higher rate of pothash because of higher translocation of food material for the formulation of seeds. Similar result confirmed these reseachers Mozaffari et al. (2012), Mir et al. (2010) and Laltlanmawi et al. (2005). Also observed that the application of potash in mustard @ 20 and 30 kg ha^{1} significantly increased seed yield and its attributes viz., siliqua plant^{1}, seed siliqua^{1} and test weight.

Seed and Stover yield:

The seed yield is a cumulative effect of different growth and yield attributing characters. Significant increase in seed yield was recorded with incremental K and Mo levels. The linear increase in seed yield could be observed with the increasing levels of K and Mo. The results reported in foregoing pages, revealed that the increasing level of potash increase the seed yield significantly up to 30 kg ha^{1}. Maximum yield (1273.36 kg ha^{1}) was observed with the application of 30 kg ha^{1} potash. Which was 986.70, 1126.95 and 1273.36 kg ha^{1}. Significantly higher to 0, 20 and 30 kg ha^{1} treatments respectively. Whereas, in molybdenum, maximum yield (1265.33 kg ha^{1}) was observed with two sprays of molybdenum which was 7.80 and 8.11 % significantly higher over to control and one spray of molybdenum treatments respectively. Seed yield noted 870.87 to 1444.08 kg ha^{1} under different treatments combination of potash and molybdenum. Maximum seed yield (1444..08 kg ha^{1}) observed with K_2 Mo_2 which was significantly higher over rest all the treatment combination except K_2 Mo_1 and K_1 Mo_2 which show non significant difference from each other. The probable reason may be that the increasing potash levels resulted in greater accumulation of carbohydrates, protein and their translocation to the productive organs, which in turn, improved all growth and yield attributing character, resulting more seed yield. Besides this, the addition of spray of molybdenum helps different metabolic process which also helps in more productive organs, which in turn, improved all growth and yield attributing character resulting more seed yield. The finding confirm the results of (Tiwari et al. 2012, Mozaffari et al. 2012, Mir et al. 2010 and Laltlanmawia et al. 2005).

CONCLUSSION

Three level of Potash (0, 20 and 30 kg/ha) and three level of Molybdenum (0, 1 ppm and 2 ppm). Growth parameter viz. plant height, No. of leaves and root length plant^{1}, yield attributes viz. number of siliqua plant^{1}, number of seeds siliqua^{1}, and grain test weight were obtained significantly increased due to increasing levels of potash and no. of spray of Molybdenum. Their interaction was also significant. The yield noted 870.87 to 1444.08 kg ha^{1} under different treatments combination of potash and molybdenum. The maximum seed yield (1444.08 kg ha^{1}) observed with K_2Mo_2 which was significantly higher over rest all treatment combination except K_2Mo_1 and K_1Mo_2 which show non significant difference from each other.

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