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Effect of potassium application on seed yield of mustard in Agra

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Abstract
Field experiments were conducted at Dry land research farm, Bichpuri, Agra for three consecutive years to find out the response of mustard to potassium application against RDF in terms of seed yield. In Agra, farmers, in general, apply recommended dose of N and P fertilizers omitting potassium (K) from their fertilization schedule. This lack of K may be responsible for low yields and poor crop quality apart from other major physiological and biochemical requirements in plant growth. Seed yield and productivity of mustard still can be further improved in Agra by use of balanced fertilization. Application of 40 and 60 kg k/ha along with RDF increased the seed yield of mustard by 22.77 and 23.15% respectively over RDF (Only N and P were applied). Seed yield obtained with 40 and 60 kg K/ha were statistically at par during all three years, implying the application of 40 kg K/ha along with 100% RDF was good enough to meet the K requirement of mustard grown on low to medium status soils of Agra district.

Keywords: mustard, seed yield, potassium, recommended doses of fertilizers (RDF)

Introduction
Indian agriculture needs to be more knowledge intensive in order to keep pace with the growing population pressure and diminishing land and energy resources. The oil seed group of crops play a significant role in Indian's agrarian economy. A substantial proportion of the Indian population lives on a vegetarian diet in which vegetable oil constitutes an important part as source of energy, essential fatty acids and amino acids. Domestic consumption of edible oils has increased substantially over the years and likely to increase further with enhancement in income and population. India is the fourth largest edible oil economy in the world and contributes about 10% to the world's oil seed production, 6-7% to the global production of vegetative oils and nearly 7% to the protein meal.

Mustard is an important *rabi* season oilseed crop grown mainly in states of Madhya Pradesh, Maharashtra, Rajasthan, Uttar Pradesh, Karnataka, Tamil Nadu, Haryana and West Bengal. Major constraint limiting the productivity of oilseeds is that these are predominantly raised on under energy-starved conditions. Since the growth and productivity of any crop species are governed to a great extent by its surrounding environments, hence, type and amount of fertilizers applied exert a considerable influence on the growth and mineral composition of the crop plants (Singh *et al*, 2010; Singh and Thenua, 2016) [6, 8]. In Agra, farmers, in general, apply recommended dose of N and P fertilizers omitting potassium (K) from their fertilization schedule. This lack of K may be responsible for low yields and poor crop quality apart from other major physiological and biochemical requirements in plant growth. Seed yield and productivity of mustard still can be further improved in Agra by use of balanced fertilization. In the present investigation, the response of mustard yield to varying levels of K was studied during three crop growing seasons.

Materials and Methods
The investigation was carried out at Dry land research farm R.B.S. College, Bichpuri, Agra during *rabi* season of 2015-16, 2016-17 and 2017-18. The experimental soil was sandy loam having pH 7.8, 7.9 and 7.8 during 2015-16, 2016-17 and 2017-18 respectively. Experimental site was low in available N (138, 142, 139 kg/ha) and available P (17, 19, 20 kg/ha) and moderate in available K (110, 112, 113 kg/ha). The experiment included four treatments: T_1- N_{60} $P_{40}K_0$ (Recommended dose of fertilizers), T_2- 75% RDF ($N_{45}P_{30}$) + K_{20}, T_3- 100% RDF($N_{60}P_{40}$) + K_{40}, T_4- 125% RDF($N_{75}P_{50}$) + K_{60}. All the treatments were replicated four times in a randomized complete block design. Half of N and full dose of P and K were applied at the time of sowing as per treatments. The remaining half of N dose was applied at first irrigation. All necessary agronomic practices were followed during experimentation. Seed yield were recorded at maturity. Statistical analysis of data was carried out by ANOVA in a randomized block design.

Results and Discussion

Table 1: Effect of potassium on seed yield of mustard

Treatments	Seed yield (kg/ha)			
	2015-16	2016-17	2017-18	Average yield
T_1- $N_{60}P_{40}K_0$	1840	1864	1854	1853
T_2- $N_{45}P_{30}K_{20}$	1880	1918	1900	1899
T_3- $N_{60}P_{40}K_{40}$	2240	2305	2280	2275
T_4- $N_{75}P_{50}K_{60}$	2260	2312	2275	2282
CD	52.22	57.60	55.30	

Application of 20 kg K/ha or 40 kg K/ha or 60 kg K/ha in soil along with 75% RDF, 100% RDF and 125% RDF increased the

seed yield of mustard over RDF during every year of experiment. The higher seed yield can be attributed to better crop growth due to application of K or other nutrients and more translocation of photosynthates from source to sink (Tripathi *et al*, 2010). Singh and Pal (2011) [7] reported positive effect of application of nutrients on yield attributes of Indian mustard. Small response of K application on seed yield was observed by Wetter *et al*, 1970 [5]; Stabbetorf, 1973; Holmes and Ainsley, 1977 & 1978 [1] and Sheppard and Bates, 1980 [3]. Mean seed yield of mustard obtained with 75% RDF + 20kg K/ha, 100% RDF + 40 kg K/ha and 125% RDF + 60 kg K/ha increased by 2.48%, 22.77% and 23.15% respectively over RDF. Significant increase in yield of mustard due to potassium application was also reported by Singh *et al*, 2010 [6]. Differences in the seed yield of mustard with application of 100% RDF + 40 kg K/ha and 125% RDF + 60 kg K/ha were statically non-significant, which implies that application of 40 kg K/ha along with 100% RDF met the K requirement of mustard. Increase in seed yield with K application is in accordance with essential role of K in process including photosynthesis, water relationships, protein synthesis and the requirement of K for at least 60 different enzyme systems within the plant.

Conclusion

Seed yield of mustard increased significantly with the application of 100% RDF + 40 kg K/ha and 125% RDF + 60 kg K/ha over RDF. However, there was no significant difference between the seed yield obtained under 40 and 60 kg K/ha treatments during all three years. It is concluded that application of 40 kg K/ha is good enough to meet the potassium requirement of mustard grown on low to medium K status Agra soils.

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