



P-ISSN: 2349-8528

E-ISSN: 2321-4902

IJCS 2019; 7(5): 739-740

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Received: 13-07-2019

Accepted: 15-08-2019

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Effect of Rock Phosphate, Sulphur and Biofertilizer on Growth, Yield attribute and Yield of Mustard (*Brassica juncea* L.)

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Abstract

The present study was undertaken to evaluate the effect of rock phosphate, sulphur and bio-fertilizer on growth, yield attribute, yield and economics of mustard (*Brassica juncea* L.) var. Bio-902 under Southern Rajasthan. A field experiment was conducted during *rabi* season of 2015-16 at Instructional Farm (Agronomy), Rajasthan College of Agriculture, Udaipur (Rajasthan). The experiment was laid out according to randomized block design with three replications. The treatments consisting of three levels of rock phosphate (control, 30 kg ha⁻¹ and 60 kg ha⁻¹), three levels of sulphur (control, 20 kg ha⁻¹ and 40 kg ha⁻¹) and two levels of bio-fertilizer (control and PSB) were applied to the mustard as soil application with uniform application of nitrogen, potassium as per recommended doses. The results indicate that the plant height, test weight, seed, stover and biological yields of mustard significantly increased with the application of rock phosphate, sulphur and bio-fertilizer during year of experiment.

Keywords: Mustard, rock phosphate, sulphur, bio-fertilizer, yield and harvest index

Introduction

Rapeseed and mustard are important oilseed crops of the family cruciferae and occupy prominent place among oilseed crops being next to soybean. India is second in rapeseed and mustard production to China and first in area. It occupies 6.41 million ha area with 6.57 million tonnes of production (Anonymous, 2016-2017) [1]. In Rajasthan, rapeseed and mustard occupy prime place amongst all the oilseed crops grown in the state, occupying 2.56 million ha area and 2.95 million tonnes production (Anonymous, 2016-2017) [1]. Rajasthan ranks first both in area and production of rapeseed and mustard in the country (Jat *et al.*, 2013) [5]. The most important reason responsible for poor productivity is inadequate supply of nutrient and poor fertility status of soils. About 98% of the cultivated soils of India need phosphorus fertilization for good yield. Phosphorus fertilization is a major input in crop production phosphorus is beneficial for vigorous growth, bumper yield, better and quality in crops. It participates in metabolic activities as a constituent of nucleoprotein and nucleotides and also plays a key in the formation of energy rich bond phosphate like adenosine diphosphate and adenosine triphosphate. In areas where mustard is traditionally grown without phosphorus, poor growth and yields are common features. Thus, phosphorus influences the vigour of plants and root growth. It also counteracts the harmful effect of excess nitrogen in the plants (Sahoo *et al.*, 2017) [8]. The yield maximization cannot be expected from the use of NPK fertilizers also but sulphur must be included in the fertilization programmes. Sulphur is now rightly called the fourth major element of the plant next only to N, P and K. In mustard crop apart from N and P, the need for secondary nutrient specially sulphur is frequently felt and a deficiency of these nutrient has deleterious effect on plant productivity. Thus, the importance of sulphur in increasing seed yield in oilseed is well recognized (Meena *et al.*, 2014) [7]. Bio-fertilizer are known to play a number of vital roles in soil fertility crop productivity and production in agriculture as they are eco-friendly but cannot at any cost replace chemical fertilizers that are indispensable for getting maximum crop yields (Sharma *et al.*, 2016) [9].

Materials and Methods

The field experiment was carried out during *rabi* season of 2015-16 at Instructional Farm, Rajasthan College of Agriculture, MPUAT, Udaipur (Rajasthan). The experimental soil was sandy clay loam in texture, slightly alkaline in reaction pH, medium in available nitrogen (275.

65 kg ha⁻¹), phosphorus (40.21 kg ha⁻¹) and high in potassium (453.12 kg ha⁻¹). The crop was sowing on 03 Oct. 2015 with recommended seed rate of 5 kg ha⁻¹. The data pertaining to plant height, test weight, seed yield, stover yield, biological yield and harvest index of the crop at harvest were evaluated.

Results and Discussion

Growth and yield attribute

The plant height and test weight of mustard significantly

increased due to application of rock phosphate up to 60 kg ha⁻¹ and 40 kg S ha⁻¹ along with bio fertilizer as compared to control, but remained at par with 30 and 20 kg ha⁻¹, respectively (Table 1). It is established fact rock phosphate, sulphur and bio fertilizer that improves the physical and biological properties of soil including supply of almost all the essential plant nutrients for the growth and development of plants Kumar and Kumar (2011) [6], Meena *et al.*, (2014) [7] and Sharma *et al.*, (2016) [9].

Table 1: Effect of rock phosphate, sulphur and bio-fertilizer on plant height, test weight, yields and harvest index of mustard

Treatments	Plant height (cm) at harvest	Test weight (g)	Yields (kg ha ⁻¹)			Harvest index (%)
			Seed	Stover	Biological	
Rock Phosphate (kg ha⁻¹)						
Control	173.52	3.98	1061.78	2313.41	3375.20	32.08
30	182.41	4.18	1236.95	2823.53	4060.47	30.88
60	188.10	4.24	1357.12	3003.16	4360.28	31.28
SEm±	3.06	0.02	26.58	81.31	80.05	0.77
CD (p=0.05)	8.80	0.06	76.38	233.70	230.06	NS
Sulphur (kg ha⁻¹)						
Control	175.36	3.97	1066.20	2269.90	3336.09	32.59
20	180.92	4.16	1250.39	2829.87	4080.26	31.15
40	187.75	4.27	1339.26	3040.33	4379.59	30.49
SEm±	3.06	0.02	26.58	81.31	80.05	0.77
CD (p=0.05)	8.80	0.06	76.38	233.70	230.06	NS
Bio-fertilizer						
Control	177.68	4.09	1150.29	2330.23	3480.52	33.46
PSB	185.01	4.18	1286.95	3096.50	4383.45	29.37
SEm±	2.50	0.02	21.70	66.39	65.36	0.63
CD (p=0.05)	7.18	0.05	62.36	190.81	187.84	1.81

Yield

The data presented (Table 1) shows that the seed, stover and biological yield of mustard significantly increased with the application of 60 kg ha⁻¹ rock phosphate and 40 kg S ha⁻¹ and bio fertilizer over control and 30 kg ha⁻¹ & 20 kg S ha⁻¹, respectively. However, application of 30 and 60 kg ha⁻¹ rock phosphate and 20 and 40 kg S ha⁻¹ were found statistically at par with each other in respect of stover yield. The significant increase in seed, stover and biological yield under the influence of rock phosphate and sulphur were largely a function of improved growth and yield attributes like plant height and test weight which consequently increased yield of mustard *i.e.* seed, stover and biological Gangwal *et al.*, (2011) [3], Dubey *et al.*, (2013) [2], Hadiyal *et al.*, (2017) [4].

Harvest index

The critical examination of data (Table 1) revealed that harvest index was non-significant with increasing levels of rock phosphate and sulphur while, effect of bio-fertilizer on harvest index was significant.

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