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Short Note

Effects of different levels of npk and sulphur on mustard (*Brassica juncea* L.) Cv. Varuna, economics analysis

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Abstract
The field experiment was carried out at Research field of Department of Soil Science, Allahabad school of Agriculture, During *rabi* season of 2014-15. The experiment was laid out in 3×3 factorial randomized block design with 9 treatments in three replications. It indicates that application of N P K and Sulphur increased the total cost of cultivation of Mustard markedly. The maximum total cost of cultivation (₹34811.53 ha^{-1}) and the minimum net return (₹ 23151.5 ha^{-1}) was computed with application of 25 kg N ha^{-1}, 40 kg P ha^{-1}, 40 kg K ha-1 and 100 g Sulphur ha^{-1} while the maximum net return ₹ invested (1.93) was recorded with the application of 25 kg N ha^{-1}, 40 kg P ha^{-1}, 40 kg K ha^{-1} and 100 g Sulphur ha^{-1}. There should be a chance of better yield and net income, suggested all operations will be performing timely for this crop, because time is a very important factor and play great role for greater yield and its quality, before time or after time any operations in the field of agriculture production and quality will goes down. However, since these finding are based on one-year experiment and therefore, further research may be conducted to substantiate it under Allahabad agro climatic conditions.

Keywords: NPK, Sulphur on Mustard, Economic analysis

Introduction
Indian mustard (*Brassica juncea* L.) commonly known as raya, rai or lahi is an important oilseed crop among the Brassica group of oilseed in India. It's the second most important edible oilseed crop in India after groundnut and accounts for nearly 30% of the total oilseeds produced in the country. Rapeseed-mustard is an important group of edible oil seed crops and contributes around 26.1% of the total oil seed production and contributes about 85% of the total rapeseed–mustard produced in India (Meena *et al.* 2011). The first position in area and second position in Production after China (Anonymous 2009) [1].

Nitrogen is the most important nutrient, which determines the growth of the mustard crop and increases the amount of protein and the yield. Phosphorus and potash are known to be efficiently utilized in the presence of nitrogen. It promotes flowering, setting of siliqua and in increase the size of siliqua and yield. Sulphur is also an important nutrient and plays an important role in physiological functions like synthesis of cystein, methionine, chlorophyll and oil content of oil seed crops. It is also responsible for synthesis of certain vitamins (B, biotin and thiamine), metabolism of carbohydrates, proteins and oil formation of flavored compounds in crucifers. *Brassica* has the highest sulphur requirement owing to the presence of sulphur rich glucosinolates. (Bharose *et al*., 2010) [10].

Phosphorus is an element for Toria and mustard. Several scientists of the world have reported that the Toria gives significant response of added phosphorus deficient soils. Phosphorus is generally deficient in majority of our Indian soils and need much attention for maintenance of soil fertility. Several experiments have been conducted under varying agro-climatic conditions by research of different countries. They have reported that phosphorus application in general had beneficial Effect in imparting plant vagour and resistance of plants, against insect pest and disease, and increasing the vegetative growth and seed yield of Toria and mustard. When Phosphorus was applied in conjunction with nitrogen and potash, there was significant increase in the yield of Toria and mustard.

Potassium is one of the seventeen elements which are essential for growth and development of plants. It's for improving the yield and quality of different crops because of its effect on photosynthesis, water use efficiency and plant tolerance to diseases, drought and cold as well for making the balance between protein and carbohydrates. (Singh *et al*., 2010) [11] Sulphur plays the key role is most important among the secondary nutrient in the production of oilseed crops. It plays significant role in the development of seed. An oilseed crop requires sulphur comparatively higher than other nutrient and it is now being recognized as the fourth major element of the plant. Primary nutrient of plants are nitrogen, phosphorus and potassium. Phosphorus plays a vital role in photosynthesis, respiration, cell conclusion cell enlargement and several other processes in living plants. Average over a large amount of data the application of sulphur increased crop yield by 17% in rice 25% in soybean 20% in sunflower and 16% in linseed. (Anonymous, 2011).

The oil content of the yellow mustard seeds ranges from 31-37 % and 20-40 % protein. The seed and oil are used as condiments in the preparation of pickles and for flavoring curries and vegetables. The oil cake is mostly used as a cattle feed and the leaves of young plants are used as green vegetables. The use of mustard oil for industrial purposes is rather limited on account of its high cost. Apart from this yellow mustard cake is also used as organic manure for the soil.

The crop requires relatively cool temperate, a fair sunny and moist weather during the growing period and dry weather during harvest period. Above all the major drawback in the low yield is that is generally grown as a mixed crop potato, sugarcane and gram without the additional application of essential plant nutrient like nitrogen, phosphorus, potash and sulphur.

Material and Methods

The experiment was conducted during *rabi* season of 2014-15 at Crop research farm Department of Soil Science Allahabad School of Agriculture SHIATS Allahabad. The experimental site is located in the sub – tropical region with 25^0 27^1 N latitude 81^0 51^1 E longitudes and 98 meter the sea level *altitudes.* The experiment was laid out in a 3×3 RBD factorial design with three levels of NPK and Sulphur with nine treatments, each consisting of three replicates. The total number of plots was 27.Mustard (*Brassica juncea* L.) were sown in rabi season plots of size 2 x 2 m with row spacing 40 cm and plant to plant distance 15 cm. The Soil of experimental area falls in order of inceptisol. The soil of the experimental field is alluvial in nature, both the mechanical and chemical analysis of soil was done before the starting the experiment to ascertain the initial fertility of the soil. The soil samples were randomly collected from 0-15 cm depths at randomly prior to tillage operations. The samples were mixed depth viz. and its weight was reducing by air drying, conning, quartering and passing it through 2mm sieve. To obtain composite soil sample in respective to different depth viz. the soil was stored for mechanical chemical analyzed. The treatment consisted of nine combination of inorganic source of fertilizers T_0-(@ 0:0:0 kg NPK ha^{-1} + 0 kg Sulphur ha^{-1}), T_1-(@ 0:0:0 kg NPK ha^{-1} + 20 kg Sulphur ha^{-1}), T_2-(@ 0:0:0 kg NPK ha^{-1} + 40 kg Sulphur ha^{-1}), T_3-(@60:40:20 kg NPK ha^{-1} + 0 kg Sulphur ha^{-1}), T_4-(@60:30:20 kg NPK ha^{-1} + 20 kg Sulphur ha^{-1}), T_5-(@60:30:20 kg NPK ha^{-1} + 40 kg Sulphur ha^{-1}), T_6-(@120:60:40 kg NPK ha^{-1} + 0 kg Sulphur ha^{-1}), T_7-(@120:60:40 kg NPK ha^{-1} + 20 kg Sulphur ha^{-1}), T_8-(@120:60:40 kg NPK ha^{-1} + 40 kg Sulphur ha^{-1}). The source of NPK and Sulphur Urea, DAP, MOP and Zinc sulphate respectively.

Results and Discussion

Treatment	Seed yield (q ha^{-1})	Stover yield	Sale Rate (₹ ha^{-1})		Gross return (₹ha^{-1})	Cost of cultivation (₹ha^{-1})	Net return (₹ha^{-1})	B:C ratio
			Seed ha^{-1}	Stover				
T0	13.62	28.35	43584.00	4252.50	47836.50	24685	23151.5	1.93
T1	14.33	29.79	45856.00	4468.50	50324.50	26684.95	23639.55	1.88
T2	15.50	32.12	49600.00	4818.00	54418.00	28684.95	25733.05	2.89
T3	18.67	38.48	59744.00	5767.50	65511.50	27745.29	37766.21	2.36
T4	19.83	40.79	63456.00	6118.50	69574.50	29748.24	39826.26	2.33
T5	20.80	42.72	66560.00	6408.00	72968.00	31748.24	41219.76	2.29
T6	20.08	41.29	64256.00	6193.50	70449.50	30811.58	39637.92	2.28
T7	21.20	43.52	67840.00	6528.00	74368.00	32811.53	41556.47	2.26
T8	22.00	45.12	70400.00	6768.00	77168.00	34811.53	42356.27	2.21

Cost of cultivation was worked out on per hectare basis. Economics of different treatment combination was worked out by taking into account the cost of cultivation and sale value of produce. The gross income and return ₹invested were worked out as follows for each treatment combination.

- Gross income (₹ha^{-1}) = Cost of seed (₹ha^{-1}) + cost of stover (₹ha^{-1})
- Net return (₹ha^{-1}) = Gross income (₹ ha^{-1}) – Total cost of cultivation (₹ha^{-1})
- Net return (₹ha^{-1}) invested = Net return (₹ha^{-1}) / Total cost of cultivation (₹ha^{-1})

The data given in Table 1 indicates that application of N P K and Molybdenum increased the total cost of cultivation of black gram markedly. The maximum total cost of cultivation (₹ 22356.8 ha^{-1}) and the minimum net return (₹3406.6 ha^{-1}) was computed with application of 30 kg N P K and 100 g Molybdenum ha^{-1} while the maximum net return ₹ invested (1.93) was recorded with the application of 12.5

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Conclusion

The maximum net return ₹ invested (2.36) was recorded with the application of 60:40:20 kg N P K ha^{-1} and 0 kg Sulphur ha^{-1}.

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