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AK Srivastava
Scientist, KVK Dhanbad, Jharkhand, India

Mahesh C Jerai
Scientist, KVK Latehar, Jharkhand, India

NK Pandey
Dy. PD ATMA Dhanbad, Jharkhand, India

Dhiraj Kumar
Horticulturist IIT (ISM) Dhanbad, Jharkhand, India

Correspondence
AK Srivastava
Scientist, KVK Dhanbad, Jharkhand, India

Effect of application of Potash on the Yield of Cabbage

AK Srivastava, Mahesh C Jerai, NK Pandey and Dhiraj Kumar

Abstract
Potassium (K), an essential macronutrient taken up by the plant in very large quantities, plays a fundamental role in plant physiology and biochemistry and activates more than 60 enzymes, has a direct function in protein synthesis, exerts an outstanding influence on plant water relations and is essential in the process of growth and development of cells. Potassium also plays a major role in photosynthesis in both the light and dark reactions culminating in the formation of sugar via the reduction of carbon dioxide. The present experiment was carried out to assess the feasibility Potash use in cabbage production in Dhanbad district. The on farm trial was conducted in 10 location in the district in different farmers field, because the demand of the cabbage is very high and the yield is very low. The yield and B:C ration is higher in case of technology option 4 in which split doses of potash is used as compared to no use and recommended dose of potash. Therefore, split dose of potash is recommended in cultivation of cabbage.

Keywords: Potash, Physiology, Macronutrient, Mridaparikshak

Introduction
Soil fertility is very closely dependent on the presence of adequate supplies of mineral plant nutrients. Many soils, however, are unable to meet nutrient demands, particularly those supporting high yielding crops, so fertilizers have to be applied to the soil. Potassium (K), an essential macronutrient taken up by the plant in very large quantities, plays a fundamental role in plant physiology and biochemistry (Marschner, 2012; Mengel and Kirkby, 2001). It activates more than 60 enzymes, has a direct function in protein synthesis, exerts an outstanding influence on plant water relations and is essential in the process of growth and development of cells. Potassium also plays a major role in photosynthesis in both the light and dark reactions culminating in the formation of sugar via the reduction of carbon dioxide. Potassium is also essential for the loading and transport of the sugar produced to developing fruits and roots, processes of extreme importance in the production of fruits and vegetables. It also enhances crop resistance to biotic and abiotic stresses including insects, pests and various diseases, as well as drought and frost (Cakmak, 2005) and is beneficial in extending the keeping quality of crop produce. On many soils the application of K fertilizers is needed to increase yields and quality of crops. Our objective was also to use the data obtained to provide information in recommending K application rates for vegetable crops in the region. Additionally, the work was initiated to establish the benefit cost ratio (BCR), in relation to likely increased yields and the most profitable return to farmers when taking into account the fertilizer cost and crop sale value.

Materials and methods
The present experiment was carried out to assess the feasibility Potash use in cabbage production in Dhanbad district. The on farm trial was conducted in 10 location in the district in different farmers field, because the demand of the cabbage is very high and the yield is very low. Farmers of the district do not apply or apply the potash in the cabbage is very low quantity which does not show their impact on yield. The four treatment were designed In first experiment i. e. Farmers Practice in which FYM 1ton/hac and 80Kg Nitrogen and 40 Kg Phosphorus were given per hectare. In the second experiment the manures and fertilizer used as FYM@2t/ha + $N_{80}P_{40}K_{20}$). In the third experiment recommended dose of fertilizer (RDF)+ $N_{120}P_{60}K_{60}$). In the forth experiment the dose is given as RDF($N_{120}P_{60}K_{20}$) basal dose+20kg K after 20 days of transplanting+ 20Kg after 40 days of transplanting. The experiment were carried out in Rabi 2014 and 2015 to test their response to K application on yield and nutrient uptake

Results and discussion

Difference in technology being adopted by the farmer and the technology being recommended

Packages of Practices	Farmers Practice	Technological option 1	Technological option 2	Technological option 3
Seed rate (kg/ha)	0.8 kg	0.8 kg	0.8 kg	0.8 kg
Spacing	60x45 cm	60x45 cm	60x45 cm	60x45 cm
Age of seedling	25 days	25 days	25 days	25 days
Manures and Fertilizer	FYM @1t/ha+$N_{80}P_4$	FYM@2t/ha + $N_{80}P_{40}K_{20}$)	RDF ($N_{120}P_{60}K_{60}$)	RDF ($N_{120}P_{60}K_{20}$) basal dose+20kg K after 20 days of transplanting+ 20Kg after 40 days of transplanting
Weeding	2	2	2	2
Irrigation	As per requirement	As per requirement	As per requirement	As per requirement

The in above table depict that the seedling of all experiments were grown and transplanted at same time. All the components of package of practices are same in all the experiments, so that all the attributes of performance should be determined.

Soil status before and after harvest of cabbage

Soil samples were collected randomly from the top soil (0-15 cm) and analyzed for physico-chemical properties prior to the onset of the experiment. The experimental soil was light acidic in reaction (pH 6.1) and low in organic carbon (C) (0.42%). Available N, P and K values obtained from sampling the experimental fields were 229, 20.2 and 129.8 kg ha–1 respectively, indicating a deficiency in N and medium levels of available P and K. During the experiments all necessary agronomic practices were followed when and where required. At maturity, the crops were harvested and fresh and dry matter yields determined as per treatment. Soil pH, EC, and available NPK were analyzed by Mridaparikshak The soil testing of the field before and after also done to access the level of the nutrients in the field. The results of the test in given below

Treatment	Soil status after harvest (Kg/ha)				OC%	pH	EC
	N	P_2O_5	K_2O	Sulpher			
T_1	280	28.2	146.4	28.2	0.62	6.1	0.16
T_2	259	32.2	153.2	32.4	0.68	6.1	0.08
T_3	281	32.4	159.2	37.6	0.72	6.1	0.14
Initial soil status	229	20.2	129.8	22.8	0.42	6.1	0.18

The parameter of judging were germination percentage of seed, Size of the head, weight of the cabbage, Yield. Cost of cultivation and benefit cost ratio and chemical soil analysis. These are main attributes to assess the application of the potash in the cabbage for boosting yield in the district

Performance indicators for determining suitability of effect of split dose of Potash on the yield of cabbage

Technology option	No. of replication	Germination %	Weight of head (cabbage) in Kg	Yield (Qt)	Cost of cultivation	Gross return (Rs/ha)	Net return (Rs/ha)	B C Ratio
Farmers practice	10	89	1.25	437.5	73500	218750	145250	3:1
Technological Option1		93	1.45	507.5	74500	253750	179250	3.4:1
Technological Option 2		93	1.72	612.5	77500	306250	228750	4:1
Technological Option 3		93	1.95	682.5	78200	341250	263050	4.4:1
S Em ±				8.418				
CD (0.05)				19.04				

The above table clearly indicate that, the performance of the Technological option 4 in respect of weight of the head (1.95Kg) is greater than the farmers practice (1.25 Kg) and also high in technology option 1 and 2. The yield of the plot in which potash was used as split dose gave higher yield (682.5Q/h) is higher than farmers practice, half dose of fertiliser and recommended dose of fertiliser 437.5, 507.5 and 612.5 quintal/ha respectively. The cost of cultivation of cabbage was somewhat similar not very big difference, the cost of farmers practice was Rs 73500 while the cost of cultivation in split dose of potash i.e. experiment 4 was Rs.78200. The gross return of farmers practice was very low as compared to using potash in split dose i.e. technological option$_4$. In concern to net return, the technological option$_4$ was higher (55.2%) than technological option$_1$. The benefit cost ratio of the farmers practice was only 3.4:1while the benefit cost ratio of experiment$_4$ was 4.1:1and also higher than other experiments. It means using split dose of potash enhance the yield of the cabbage.

Constraints

The basic constraints reported by farmers during the assessment of effect of using split dose of potash at different stage was lack of knowledge about application of potash in cabbage and none farmers heard about effect of application of split dose in cabbage. The farmers of the district generally does not use potash in the crop and vegetables. This was the major constraints faced by farmers.

Conclusion

Potash applied with recommended dose ($N_{120}P_{60}K_{20}$) basal dose+20kg K after 20 days of transplanting+ 20Kg after 40 days of transplanting, performed better in terms of yield, gross return, net return and benefit cost ratio and proved superior than farmers who generally not applied potash in cabbage crop. The yield of the split dose and recommended dose was also not at par with the using potash in different dosed in different stage of growth of the crop. Generally farmers used potash as basal dose at the time of transplanting.

Therefore, it is recommended to the farmers of the district to use recommended dose in to different growth stage of the cabbage. This crop is suitable for all types of farmers whether large, medium and small and give better cash return from cultivation since, the demand of cabbage is round the year

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