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IMPACT OF POTASH MOBILIZING BACTERIA (KMB – SEED TREATMENT) ON YIELD OF POTATO CROP

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ABSTRACT
The objective of the present study was to evaluate the effect of KMB as seed treatment, on the total yield of potato crop variety Kufri Jyoti. The seed potato of variety Kufri Jyoti were treated with various concentrations of KMB (1, 3, 5 and 7 % concentration, indicated as T1, T2, T3 and T4 respectively) followed by control (T5 - without KMB seed treatment). The observation of the present study indicates that KMB 5% (T3) found most suitable concentration to treat the seed to increase the total yield of potato crop variety Kufri Jyoti in comparison to all other concentrations i.e. 1,3, 7 Kg/ha (T1, T2, T4) and in comparison to control (T5) also.

KEY WORDS: Potash mobilizing bacteria, KMB and potato.

INTRODUCTION

Potato is a global crop planted in a wider range of altitude, latitude, and climatic conditions. No other crop can match the potato in its production of food energy and food value per unit area (Davies et al., 2005). Nutrition analysis showed that potato is a healthy food in terms of vitamins, minerals, proteins, antioxidants, essential amino acids and carbohydrates (Andre et al., 2007). However, there are many problems surrounding potato cultivation. One problem is that potato plant has one of the heaviest production demands for fertilizer inputs of all vegetable crops. Normal fertilizer application is around 1000 kg ha-1 10N-3P2O5-10K2O. N requirements are as high as 336 kg ha-1 in traditional production system for an expected yield of 5000 kg ha-1 (Davies et al., 2005; Lang et al., 1999). Current agriculture are facing increased cost of synthetic fertilizer, (agro) ecosystems desiccation caused by extensive use of water in crop production (Whitley and Davenport, 2003) and subsequent reduction in water supplies for irrigation, heightening publication about the environmental and healthy impact of biocide overuse (Lotter, 2003), and the nitrate leaching from overuse of fertilizers, therefore, a new program must be developed to address these challenges. Thereafter, applying beneficial microbial inoculants are emerging as a promising alternative for maintaining a sustainable agriculture system. Evidence shows that maintenance of sustainable soil fertility depends greatly on the ability to harness the benefits of plant-growth-promoting bacteria (PGPB) such as N-fixing, P-solubilizing bacteria (PSB), mycorrhizal helper bacteria (MHB), endophytes, and arbuscular mycorrhizal fungi (AMF) (Barea et al., 2005; Smith and Read, 2008). The special focus on K solubilizer was due to the fact that potassium is one of the major nutrients required by all crops. It is a key element in many physiological and biochemical processes. Mineral potassium solubilization by microbes which enhances crop growth and yield when applied with a cheaper source of rock potassium may be agronomically more useful and environmentally more feasible than soluble K (Rajan *et al.,* 1996). Potassium solubilizing bacteria are capable of solubilizing rock K, mineral powder such as mica, elite and orthoclases through production and excretion of organic acids (Fridrich *et al.,* 1991). Current interest in the potassium fertility of soil has been changed from simple estimation of exchangeable K to measurement of the rate at which K is supplied from exchangeable fractions. Rate of non exchangeable K release and its mechanism are controlled by nature and amount of clay minerals, besides this exploring the role of microbes present in the soil also stared this exploring the role of microbes present in the soil also starded recently. According to preliminary studies and crop response studies gives encouragement in this line (Chandra *et. al.,* 2000, Chandra *et. al.,* 2005). An interesting finding was made from Banana rhizosphere by Dr. Krishna Chandra during 1998 and noticed a microbe is predominant and play vital role in help plants in potassium nutrient uptake. Later it was authenticated by Institute of Microbial Technology (IMTECH), Chandigarh as *Frateuria aurentia* and known as Potash Mobilizing Bacteria (KMB), belonging to the family Pseudomonaceae. KMB is a beneficial free living soil bacteria isolated from rhizosphere of plants, which have been shown to improve plant health or increase yield are usually referred to as plant growth promoting rhizobacteria - PGPR (Kloepper *et. al.,* 1980). A number of different nitrogen fixing and phosphate solubilizing bacteria may be considered to be PGPR including *Azotobacter, Azospirillum, Rhizobium* other bacterial genera e.g. *Arthrobacter, Bacillus, Burkholderia, Enterobacter, Klebsiella, Pseudomonas* etc. also reported as PGPR. According to Chandra *et. al.,* 2005 and field trials, *Frateuria aurentia* also to be considered as PGPR.

MATERIALS & METHODS

Potato tubers of variety Kufri Jyoti (35 – 45 mm size) was taken as planting material. The effect of KMB was examined by treated the seeds before planting. In seed treatment potato tubers were wet by solution of KMB (1, 3, 5 and 7% concentration, indicated as T1, T2, T3 and T4 respectively) followed by control (T5 - without KMB seed treatment) done with spray method and were left to dried out till planting. Experiment was randomized block design with three replications for each concentration. Each concentration having 180 tubers in three replications, the observations of the study was emergence percentage and days taken for emergence, plant growth i.e. plant height and number of stem per plant, number of tuber per plant and total yield, the haulm was killed at 75 days after planting and the data for number of tuber/plant and total yield were taken at 25 days after haulm killing at harvesting.

Tubers were planted in field at the spacing of 68.6 cm x 20 cm. The amount of fertilizers were used as 420 kg/Ha Urea, 350 Kg/Ha SSP, 250 Kg/Ha DAP, 300 Kg/Ha MOP and 30 Kg/Ha Zinc in whole cropping period. During the experiment period, each day show minimum of 5.9 ^{0}C and maximum of 24.6 ^{0}C air temperature. The soil temperature was minimum of 10.3 ^{0}C and maximum of 22.3 ^{0}C.

RESULTS AND DISCUSSION

Effect of KMB seed treatment on number of tuber per plant and total yield

The number of tuber per plant was observed at 25 days after haulm killing at harvesting (Table-1), the maximum number of tuber per plant were reported in T3 (4.2 ±0.01) followed by T1 (3.6 ±0.21), T5 (3.3 ±0.23), T4 (3.2 ±0.03) and T2 (3.2 ±0.05) concentrations. The yield was observed at 25 days after haulm killing at harvesting (Table-1), the highest yield (MT/Ha) were reported in T3 (29.55±1.86) followed by T1 (25.47±5.85), T4 (24.94±1.84), T2 (24.07±3.74) and T5 (22.65±3.48) concentrations. The present study indicates that the seed treatment of KMB concentration shows positive influence on number of tuber and total yield in comparing to control. The maximum number of stem per plant was also found highest in T3 (3.4±0.40) concentration followed by T4 (3.3±0.51), T2 (3.2±0.40), T5 (3.2±0.45), and T1 (3.0± 0.00). Although the published information on the effect of KMB on potato crop and especially in the variety Kufri Jyoti is not available in the earlier literature but some other study may support the positive influence of KMB on growth and yield of a crop.

TABLE 1: Effect of KMB on number of tuber per plant and total yield

S.N.	Treatment	No. of Stem/Plant	No. of Tuber/ Plant	Yield (MT/Ha)
1	T1	3.0± 0.00	3.6±0.21	25.47±5.85
2	T2	3.2±0.40	3.2±0.05	24.07±3.74
3	T3	3.4±0.40	4.2±0.01	29.55±1.86
4	T4	3.3±0.51	3.2±0.32	24.94±1.84
5	T5	3.2±0.45	3.3±0.23	22.65±3.48
	C.D. @ 5%	*0.940*	*0.068*	*0.742*
	SE(m)	*0.387*	*0.228*	*3.687*
	SE(d)	*0.547*	*0.323*	*5.214*
	C.V.	*20.642*	*11.115*	*25.205*

Microorganisms play a key role in the natural K cycle. Some species of rhizobacteria are capable of mobilizing potassium in accessible form in soils. There are considerable population of Potssium Solubilizing Bacteria (KSB) in soil and rhizosphere (Sperberg, 1958). Silicate bacteria were found to dissolve potassium, silicon and aluminium from insoluble minerals (Aleksandrov *et al.*, 1967). It has been reported that most of potassium in soil exists in the form of silicate minerals. The potassium is made available to plants when the minerals are slowly weathered or solubilized (Bertsch *et al.*, 1985) are the major soil groups in the state. In general, black soils are high, red soils medium and lateritic soils lows in available K. Lateritic, shallow red and black soils have been found to show decline in K fertility over the years under intensive cultivation and imbalanced fertilizer application. Since K is a costly nutrient, India ranks 4th in consumption of potassium fertilizers. On an average 1.7 million tons of K is being imported annually (Anonymous, 2003). Currently, very little information is available on mineral potassium solubilization by bacteria, their mechanisms of solubilization and their effect on growth, K uptake and yield of several crops. Therefore the present investigation was undertaken to study the influence of potassium mobilizing bacteria on yield of potato crop.

The conclusion of the present study is that seed treatment by KMB at 5 % found most suitable concentration to increase the total yield of potato crop variety Kufri Jyoti in comparison to all other concentrations i.e. 1, 3, 7 % and in comparison to control also, but to establish the fact, the study must have recommended for further investigation in future. The research on this topic advised to repeat again and again to establish the fact that KMB may increase the total yield of potato crop by using in seed treatment.

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