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Influence of Magnesium Application in Combination with Lime and Potassium on the Starch Content and Seed Potatoes in the Nilgiris Soils.

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Application of magnesium increased starch content and starch yield. Potassium increased the starch yield only when magnesium was applied upto 100 kg/ha. Liming did not increase starch yield. But the interaction effects indicated that lime, potassium and magnesium fertilization have the potential to increase the starch content and yield when these are manipulated in a proper proportion. In the present study the following combinations Viz. L_1K_0 Mg_0L_1, Mg_2L_0 and Mg_1K_0 were found to increase the starch content as well as starch yield.

Magnesium as a plant nutrient especially for acid soil regions is well established. In the acid soil regions of the Nilgiris, potato is the major cash crop. Magnesium is known to be deficient in these areas, (Mathan, 1977, Mathan *et al* 1973) and magnesium has been reported to influence starch content and yield (Zimmerman, 1947 and Shukla and Singh 1976). In the present investigation an attempt has been made to find out the extent of influence of magnesium in combination with lime and potassium.

MATERIAL AND METHODS

A field trial was conducted for two seasons in Titukkal (near Oota camund) of the Nilgiris district. It was a loamy acid soil (PH 3 .8) containing 6. 3% organic carbon and 4.70, 0.99, 4.40 and 0. 20m /100g of soil of total Mg, exchangeable Mg, Ca and K respectively. Sixteen treatments involving different combinations of lime, potassium and magnesium were tried (Table 1 .) The design of the experiment was split-plot with lime and K combinations as the main plot treatments and doses of magnesium as the sub-plot treatments. The treatments were randomised and replicated six times.

FIRST CROP;

Potato *(Solanum tuberosum L.)* variety Kufri Jyothi was the test crop. Lime at the rate of 16. 8 t/ha based on the lime requirement estimation (Black, 1965) was applied to the concerned plots and mixed throughly 30 days before the commencement of the trial On the day of planting, nitrogen (60Kg N/ha) and phosphorus (240 Kg P_2O_5/ha) at the rates recommended for potato crops in the Nilgiris were applied to all the plots. Magnesium and potassium as magnesium sulphate and muriate of potash respectively were applied to plots as per the treatment schedule and mixed throughly. The crop was harvested at maturity.

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SECOND CROP:

The above trial was repeated in the same plots adopting the same treatment schedules except that lime was not added again, since the pH of the soil did not warrant further liming.

ANALYSIS:

Preplanting and post harvest soil samples were analysed for exchange able cations (K, Ca and Mg) and soil reaction (Jackson 1973). Tuber samples were analysed for starch content, colorimetrically using Erma photoelectric colorimeter with red filter (Mc Cready *et al.* 1950)

Simple correlations and regression equations were worked cut for various data collected. Second order equa tions were worked out between the yield and doses of applied magnesium.

RESULTS AND DISCUSSION

Starch content of potato tubers ranged from 22.2 to 27.3 per cent with a mean of 25.7 per cent in the first crop. The values rarged from 21.0 to 26.0 per cent with a mean of 24.0 per cent in the second crop (Table 1). Lime and potash application did not influence the starch percentage in the tubers Magnesium application at Mg_1, Mg_2 Mg_3 levels significantly increased the starch content. There was prog ressive increase in the starch content as the Mg levels Increased, but these variations were not significant (Table 2). The relationship between the exchangeable Mg in soil and starch content and yield in both the crops was positive and significant (Table 3).

This was in line with the observa-tions of other workers (Zimmerman, 1947 and Kirkby and Mengel, 1976).

During the second crop also, magnesium fertilization at Mg_1, Mg_2, and Mg_3, levels significantly increased the starch content over control Starch content at Mg_2 level was significantly higher than Mg_1 level but on par with Mg_3 level. Exchan-geable Mg content of the soil was positively correlated with the starch content ($r=0.620^{**}$).

Starch yield obtained from potatoes ranged from 9.7 to 12.7 q/ha with a mean of 11 3 q/ha (Table 1). The main plot treatment L_1 K_0 and L_0 K_1 were on par while L_1 K_0 registered significantly higher starch yield than L_0 K_0 and L_1 K_1 The lime x Mg in teraction revealed that at both limed and unlimed conditions starch yield was increased to a miximum at 100 Kg Mg/ha level beyond which it decre ased. Further at K^0 level the effect of magnesium was seen at Mg^1 level, while with K application the magne sium increased starch yield even at Mg_2 level. This indicated the supl-ementary effect of magnesium and potassium. Potassium application did increase the starch yield only at Mg_2 level, otherwise it was negative.

During the second crop, a similar result as that of first crop was obtained with Mg application (Table 2). K_1 level registered a significant decrease in starch yield, while lime application did

not show any influence on the same. The interaction of magnesium and lime indicated that at L_0 level, Mg_2 and Mg_3 registered a significantly higher starch yield over control while at L_1, Mg_1 level recorded significantly higher yield than others. At Mg_0 level liming did not influence starch yield, At Mg_1 level, liming significantly increased the starch yield, while at higher levels liming significantly decreased starch yields. These observations indicated the complementary effect of magnesium and potassium. Potassium application increased the starch yield only at Mg_2 level, otherwise it was only negative.

From the above it was clear that lime, potassium or magnesium fertilization have the potential to increase the starch content and yield as could be seen from the interactions of these nutrients. By proper selection of suitable combinations the starch yield could be improved. In the present investigation L_1K_0, Mg_0L_1, Mg_2L_0 and Mg_2L_0 were observed to be some of the better combinations for good yield However, further investigations are needed to arrive at a suitable combination of these three cations.

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TABLE 1 Effect of Treatments on Content and Yield of Starch in Potato Tubers (Solanum Tuberosum L.)

TREATMENTS	Mean of six replication - Oven dry basis			
	I Crop		II Crop	
	Starch Content %	Starch yield q/ha	Starch Content %	Starch yield q/ha
L_0 K_0 Mg_0	22.3	11.4	21.5	15.5
L_0 K_0 Mg_1	25 7	11.9	23.5	17.3
L_0 K_0 Mg_2	26.0	11 9	25.1	16.9
L_0 K_0 Mg_3	27.3	12.7	25.2	16.9
L_0 K1 Mg_0	24 3	9.7	21.0	14.7
L_0 K_1 Mg_1	25.4	10 5	23 5	18 0
L_0 K_1 Mg_2	26.1	12.6	25.0	18.2
L_0 K_1 Mg_3	26.1	11.5	26.0	18 8
L1 K_0 Mg_0	25.1	10.5	23.0	16.6
L_1 K_0 Mg_1	26.3	11.7	23.7	18.7
L_1 K_0 Mg_2	26.1	10.4	24.8	18.1
L_1 K_0 Mg_3	26 6	12.0	25.7	19.2
L_1 K_1 Mg_0	24.1	9.7	22.8	15.1
L_1 K_1 Mg_1	26.1	12.6	23.8	16.8
L_1 K_1 Mg_2	27 0	11.7	24.2	16.5
L_1 K_1 Mg_3	26.6	9.9	25.4	17.0
Mean	25.7	11.3	24.0	17.1

L_0 = No lime
L_1 = Lime at 16.8 t/ha
K_0 = No Potessium
K_1 = K at 100 Kg K_20/ha

Mg_0 = No Magnesium
Mg_1 = 50 Kg Mg/ha as Mg SO_4 $7H_20$
Mg_2 = 100 Kg/ha as Mg SO_4. $7H_20$
Mg_3 = 1 50 Kg Mg/ha as $MgSO_4$ $7H_20$

Table 2. Starch Content and yield under Mg levels

	Starch Content (%)		Starch yield (a/ha)					
	I Crop	II Crop	I Crop	II Crop	Lo	Zl	Ko	Kl
Mg_0	24.38	22.08	15.49	10.34	10 58	10.09	10.96	9.71
Mg_1	25.88	23.40	17.68	11.67	11.18	12 16	11.71	11.56
Mg_2	26 29	24 77	17 42	11.64	12.27	11.01	11 14	12.14
Pg_3	26 67	25.56	17.93	11.63	12 09	10 96	12.37	10.08
CD (P=0.05)	1.03	1.03	0.82	0.72	Mg at L	1.01	Mg at k	1.06
					L at Mg	0.96	K at Mg	0.96