GAU Res. J. 1983. 9 (1) 71-73

Correlation Studies of Potassium Extracted by Different Extractants with Yield and Uptake of Potassium by Hybrid Jowar in Calcareous Soil

M. M. Padalia, M. V. Kanzaria and C. L. Patel[1]

GAU, Junagadh Campus, Junagadh

Interest in suitable soil test for major nutrients in India increased greatly with initiation of the All India Soil Testing Programme in the mid 1950's. Several workers (Pathak *et al.* 1975; Maharana *et al.* 1976) have suggested different extractants under various soil conditions. None of the extractants is suitable for all types of soils. The present study was initiated to evaluate the best method of K extraction for highly calcareous medium black soils of Saurashtra region of Gujarat.

Field and pot-culture studies were conducted on soil whose characteristics are presented in Table 1. China clay pots of the size 27.5 cm in diameter and 22.5 cm in height containing 11.5 kg soil (2 mm sieved) were used for pot experiment. Four different soils viz. silty clay, silty clay loam, loam and sandy loam were considered as four independent treatments which were replicated seven times. Four plants of jowar 'CSH-5' (*Sorghum bicolor* (L.) Mocnch were grown for 60 days. Pots were fertilized with N@ 75 kg/ha as ammonium sulphate and P@ 37.5 kg/ha as diammonium phosphate while K was not applied. Oven dried dry matter yield was recorded.

TABLE 1

Physio-chemical characteristics of soils.

Soil characteristics	*Field soil*	*Pot soils*			
	Silty clay loam	*Silty clay*	*Silty clay loam*	*Loamly*	*Sandy loam*
pH (1 : 2.5)	8.10	8.50	8.40	8.40	8.40
Electrical conductivity mmhos/cm (1 : 2.5)	0.20	0.26	0.20	0.20	0.18
Organic carbon %	0.78	0.75	0.65	0.38	0.20
Lime %	30.66	28.50	21.00	13.80	7.00
Available K_2O kg/ha	210.00	190.00	140.00	98.00	50.00
Sand %	22.61	16.00	41.20	65.80	86.80
Silt %	39.71	45.00	29.80	16.20	3.20
Clay %	37.68	39.00	29.00	18.00	10.00

Field experiment was conducted on University Farm, Junagadh during June to November, 1976 using same variety of Jowar. The treatments consisted of six graded doses of potassium (Table 2) with four replications in a completely randomised block design. The doses and sources of N and P were

the same as those of pot experiment while K was applied as per details of treatments in the form of potassium chloride. The grain and fodder yields were recorded separately.

TABLE 2

Dry matter yield and uptake of K by Jowar 'CSH-5' in different soils (Pot experiment)

Soils	*Dry matter yield (g/pot)*	*Uptake of K(mg/pot)*
Silty clay	26.82	851.71
Silty clay loam	22.00	578.14
loamy	20.34	454.86
Sandy loam	16.27	255.43
C.D. at 5%	4.16	96.60

The soil samples from each plot and from each pot were collected 3 days after the application of fertilizer and were analysed for K. Six extractants of K viz., N NH_4OAC (pH 7.0), Morgan's reagent (NaOAC+HOAC, pH 4.8), cold H_2SO_4, HNO_3, water and constant boiling HCI were employed. Potassium from plant and soil as extracted by different extractants was determined by using Flame photometer (Systronics type 121).

Total uptake of K, grain yield and fodder yield were correlated with the K extracted by different extractants from the soils.

The results of pot experiment (Table 3) revealed that silty clay soil with highest amount of available K (Table 1) gave the maximum dry matter yield (26.82 g per pot) which was significantly superior to the yield obtained from the remaining soils. The minimum dry matter was produced in the sandy loam soil (16.27 g per pot) which was, the poorest in the available K. Low yield under the loamy and sandy loam soils may be owing to the low

TABLE 3

Effect of varying doses of K on grain and fodder yield and total uptakes of K by Jowar 'CSH-5' (kg/ha)

Treatments kg/ha	*Grain*	*Fodder*	*Total K uptake*
K_0	2545.7	9891.5	118.1
K_{12}	2541.7	10027.0	131.6
K_{24}	2829.7	10094.7	143.2
K_{36}	2779.5	10631.7	137.1
K_{48}	2810.5	10821.5	141.0
K_{60}	2859.0	11246.5	142.2
C.D. at 5%	N.S.	N.S.	N.S.

status of K which was below 131 kg/ha (Table 1). It has been shown by Bray (1945) that the soils with levels of exchangeable K less than 0.15 m.e./100 g soil (131 kg/ha) likely to respond to K application. The effect of K status of soil has been more clearly reflected in the total utilization of K by plants in different soils (Table 2), the utilization being maximum in silty clay soil with the highest available K and the minimum in the sandy loam soil with the lowest K status.

There was no effect of K_2O application on grain and fodder yield as well as uptake of K under field condition (Table 3). The lack of response of Jowar to the application of K may be due to fairly good status of K in soil (Table 1). Mehta and Shah (1956) studied the K status of soils of Western India showed that there was sufficient readily available K for crop. While summarizing thousands of experiments conducted on cultivators' fields, Goswammi *et al.* (1976) found that, in many cases responses to K has been found to be erratic and at times not predictable from soil test.

The water soluble and HCI extractable K failed to show significant

TABLE 4

Coefficient of correlation (r) between K extracted from soils by different extratacnts with yield and uptake of K by Jowar 'CSH-5'.

Extractants	NH_4OAC	Cold H_2SO_4	*Morgan's reagent*	*Boiling* HNO_3	*Water*	*HCl*
Field Experiment						
Grain yield	0.340	0.025	0.559**	0.422**	0.288	0.313
Fodder yield	0.110	0.434*	0.494**	0.719**	0.302	0.399
Uptake of K	0.604**	0.421*	0.605**	0.597**	0.303	0.117
Pot culture experiment						
Dry matter yield	0.730**	0.689**	0.699**	0.760**	0.644**	0.713**
Uptake of K	0.925**	0.906**	0.912**	0.906**	0.824**	0.914**

*Significant at 5% level.
**Significant at 1% level.

correlation either with yield or with uptake of K (Table 4). The cold H_2SO_4 extractable K gave positive correlation only at five per cent level that too with fodder yield and K uptake but not with grain yield. The N NH_4OAC extractable K also could not be correlated with grain or fodder yield, although the uptake of K gave significant correlation ($r=0.604$). The Morgan's reagent as well as boiling HNO_3 proved to be promising extractants. Of course, the boiling HNO_3 showed lower degree of correlation with grain yield.The best correlation has been shown by the Morgan's extractant with grain yield and uptake of K at one per cent level and with fodder yield at 5 per cent level. It appears from the data that under pot culture conditions, all the method of K extraction tried have given highly significant correlation with dry matter and uptake of K. This leaves the choice to the concerned as to which method to follow keeping in view the local conditions. The methods of Morgan and boiling HNO_3 seem to be better than rest of the extractants.

(Received on 19th June, 1979)

REFERENCES

Bray, R. H. 1945. Soil plant relationship II. Balanced fertilizer use through soil tests for K and P. *Soil Sci.* **60** : 463-466.

Goswami, N. N., Bapat, S. R. Leelavathi, C.R. and Singh, R. N. 1976. Potassium deficiency in rice and wheat in relation to soil type and fertility status. *Bull Indian Soc. Soil Sci.* **10** : 186-188.

Maharana, D. P. Mukherjee, S. N. Mutatkar, V. K. and Dhua, S. P. 1976. Soil test crop response correlation for potassium on rice growing soils in old alluvial tracts of Bihar. *Bull. Indian Soc. Soil Sci.* **10** : 293-296.

Mahta B. V. and Shah, C. C. 1956. Potassium status of soils of Western India-I. *Indian J. Agric. Sci.* **26** : 193-197.

Pathak, A. N., Tiwari, K. N. and Jokhoo Prasad. 1975. Evaluation of soil tests for phosphorus and potassium *J. Indian Soc. Soil Sci.* **23** : 207-210.