Potassium Supplying Power of the Major Ultisols and Oxisols of Puerto Rico[1, 2]

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ABSTRACT

The K supplying power of 17 Ultisols and 6 Oxisols typical of vast areas in the tropics was determined by cropping 181 pots, each filled with 11.4 kg (25 lb) of soil from as many sites, with Pangola grass for 4 consecutive years. During the first year of cropping the soil groups released the following amounts of K: Oxisols, 234 kg/ha (209 lb/acre); Ultisols of the uplands, 260 kg/ha (232 lb/acre); clay Ultisols of the coastal plains, 230 kg/ha (206 lb/acre); and sandy Ultisols of the coastal plains, 90 kg/ha (81 lb/acre). After the first year, K removal dropped off sharply averaging about 50 kg/ha (45 lb/acre) yearly for the Oxisols and clay Ultisols of the coastal plains, 35 kg/ha (31 lb/acre) yearly for the sandy Ultisols of the coastal plains and 90 kg/ha (80 lb/acre) for the Ultisols of the uplands. There was close agreement between various soil K values determined at the beginning and at the end of the experiment and K removal by Pangola grass over different periods. The close relationship between exchangeable K at start of the experiment and K removed by Pangola grass over the first year of cropping shows that exchangeable K values are a good criterion for evaluating the capacity of these soils to supply K to grasses.

INTRODUCTION

Fertilization is a key management practice in Puerto Rico where agriculture must be intensive due to heavy population pressure and limited land resources. Fertilizers can account for over half the cost of producing forages and, therefore, must be used efficiently.

Vicente et al.[4] found that the nitrogen supplying power to grasses of several typical Ultisols and Oxisols of Puerto Rico was similar, averaging

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[4] Vicente-Chandler, J., Abruña, F., Caro, R., Figarella, J., Silva, Servando, and Pearson, R. W., Intensive Grassland Management in the Humid Tropics of Puerto Rico, Agr. Exp. Sta. Univ. P.R. Bull. 233, Feb. 1974.

about 100 lb/acre yearly. Ultisols and Oxisols are naturally low in phosphorus and the amount available to grasses depends largely on past fertilization. On the other hand, field experiments by Vincente-Chandler et al.[4] with several Ultisols showed that the response of grasses to K fertilization can vary widely. No studies have been conducted to determine the K-supplying power of the soils of Puerto Rico to grasses through long term cropping.

The present study determined the K-supplying power of 17 Ultisols and 6 Oxisols and its relationship to soil K values by cropping with Pangola grass over a 4-year period. These soils represent over 240,000 ha (600,000 acres) in Puerto Rico as well as vast areas in the humid tropics.

MATERIALS AND METHODS

Eleven kg (25 lb) of soil from 0–30 cm (0–12 in) depths were taken at 181 sites representing the 23 soils studied. The number of sites sampled depended on the acreage of each soil in Puerto Rico and ranged from 38 with Dagüey clay (84,000 ha or 210,000 acres) to 3 with Río Lajas fine sand (1,200 ha or 3,000 acres).

Soil from each site was air dried, sieved, limed with calcium hydroxide to 60% base saturation and placed in a 3-gal pot. Phosphorus (as triple superphosphate) was applied at the rate of 112 kg/ha (100 lb/acre) yearly in one annual application. Nitrogen (as urea) was applied at the rate of 672 kg/ha (600 lb/acre) yearly in six equal applications, every time the grass was cut. A dense stand of Pangola grass was established in all the pots. The pots were thoroughly and uniformly wetted twice weekly by irrigating until water stood on the surface and then draining 2 hr later when the soil had become saturated. Water drained from each pot was used in the following irrigations, so that K in the leachate was returned to the soil. The Pangola grass was harvested every 2 months, dried and weighed to determine yield, and analyzed for K.

TABLE 1.—*Chemical characteristics of the soils studied*[1]

Soil group	pH	Organic matter	Exchangeable bases	Cation exchange capacity	Exchangeable Al
		%	*Meq/100 g*	*Meq/100 g*	*Meq/100 g*
Oxisols	5.70	5.00	8.39	11.66	0
Upland Ultisols	4.90	4.94	7.19	17.12	2.82
Clay Ultisols of the coastal plains	5.25	4.22	6.07	9.75	.57
Sandy Ultisols of the coastal plains	6.05	1.25	1.29	1.91	0

[1] Values are weighted averages for the groups into which the soils were grouped for convenience.

TABLE 2.—*K released to Pangola grass over 4 successive years of cropping in pots as related to various soil K values*

Soil type	Sites studied	Classification	K in soil at start of the experiment						K extracted by Pangola grass		K in soil at end of the experiment			
			Exchangeable		Nitric-acid extractable		Total "available"				Exchangeable		Nitric-acid extractable	
	Number		*Kg/ha*	*(lb/acre)*	*Kg/ha*	*(lb/acre)*	*Kg/ha*	*(lb/acre)*	*Kg/ha*	*(lb/acre)*	*Kg/ha*	*(lb/acre)*	*Kg/ha*	*(lb/acre)*
							Oxisols							
Catalina clay	9	Tropeptic Haplorthox	314	(280)	167	(149)	481	(429)	461	(412)	65	(58)	87	(78)
Bayamón sandy clay	7	Tropeptic Eutrorthox	115	(103)	93	(83)	208	(186)	291	(260)	56	(50)	64	(57)
Coto sandy clay	6	Tropeptic Haplorthox	241	(215)	291	(260)	532	(475)	443	(396)	68	(61)	105	(94)
Nipe clay	3	Typic Acrorthox	299	(267)	134	(120)	433	(387)	403	(360)	47	(42)	141	(126)
Rosario silty clay	5	Tropeptic Haplorthox	188	(168)	312	(279)	500	(447)	327	(292)	76	(68)	222	(198)
Matanzas clay	3	Tropeptic Eutrorthox	134	(120)	132	(118)	266	(238)	291	(260)	70	(63)	132	(118)
Weighted average			222	(198)	189	(169)	411	(367)	384	(343)	64	(57)	115	(103)
							Upland Ultisols							
Limones clay loam	6	Orthoxic Tropohumults	234	(209)	64	(57)	298	(266)	456	(407)	56	(50)	139	(124)
Torres clay	5	Orthoxic Palehumults	151	(135)	157	(140)	308	(275)	430	(384)	84	(75)	140	(125)
Humatas clay	21	Typic Tropohumults	280	(250)	199	(178)	479	(428)	566	(505)	86	(77)	138	(123)
Dagüey clay	38	Typic Tropohumults	236	(211)	133	(119)	370	(330)	561	(501)	93	(83)	118	(105)

Table 2.—*Continued*

Soil type	Sites studied	Classification	K in soil at start of the experiment: Exchangeable		K in soil at start of the experiment: Nitric-acid extractable		K in soil at start of the experiment: Total "available"		K extracted by Pangola grass		K in soil at end of the experiment: Exchangeable		K in soil at end of the experiment: Nitric-acid extractable	
	Number		*Kg/ha*	*(lb/acre)*	*Kg/ha*	*(lb/acre)*	*Kg/ha*	*(lb/acre)*	*Kg/ha*	*(lb/acre)*	*Kg/ha*	*(lb/acre)*	*Kg/ha*	*(lb/acre)*
Los Guineos clay	16	Epiaquic Tropohumults	213	(190)	99	(88)	311	(278)	444	(396)	65	(58)	134	(120)
Alonso clay	9	Orthoxic Tropohumults	263	(235)	223	(199)	486	(434)	594	(530)	101	(90)	262	(234)
Naranjito clay	5	Typic Tropohumults	237	(212)	248	(221)	485	(433)	563	(503)	92	(82)	265	(237)
Moca clay	5	Vertic Tropudults	327	(292)	143	(128)	470	(420)	749	(669)	178	(159)	205	(183)
Lares clay	7	Aquic Tropohumults	204	(182)	121	(108)	325	(290)	433	(387)	84	(75)	99	(88)
Ciales clay loam	5	Aquic Tropohumults	159	(142)	133	(119)	292	(261)	448	(400)	74	(66)	152	(136)
Weighted average			233	(208)	154	(138)	387	(346)	533	(476)	88	(79)	147	(131)
							Coastal Plain Ultisols (Clays)							
Sabana Seca clay	5	Oxic Plinthaquults	187	(167)	325	(290)	512	(457)	476	(425)	90	(80)	199	(178)
Vega Alta clay	5	Plinthic Paleudults	152	(136)	110	(98)	262	(234)	367	(328)	59	(53)	84	(75)
Espinosa clay	3	Typic Paleudults	242	(216)	97	(87)	339	(303)	402	(359)	56	(50)	34	(30)
Almirante clay	3	Plinthic Paleudults	105	(94)	108	(96)	213	(190)	284	(254)	56	(50)	84	(75)

Vega Alta sandy clay	2	Plinthic Paleudults	180	(161)	71	(63)	251	(224)	390	(348)	43	(38)	24	(22)
Weighted average			168	(150)	167	(149)	335	(299)	394	(352)	65	(58)	92	(82)
							Coastal Plain Ultisols (Sandy)							
Espinosa sandy loam	5	Typic Paleudults	74	(66)	81	(72)	155	(138)	195	(174)	56	(50)	55	(49)
Guayabo fine sand	5	Arenic Haplustults	50	(45)	112	(100)	162	(145)	200	(179)	58	(52)	93	(83)
Río Lajas fine sand	3	Arenic Rhodic Paleudults	56	(50)	102	(91)	158	(141)	194	(173)	75	(67)	53	(47)
Weighted average			53	(47)	109	(97)	162	(144)	197	(176)	60	(54)	69	(62)

Soil samples taken in all pots at start and end of the experiment were air dried, ground, passed through a 20-mesh sieve, and analyzed for exchangeable K by the ammonium acetate method and for hot-nitric-acid-extractable K.

RESULTS AND DISCUSSION

Table 1 shows some chemical characteristics of the soils studied which were divided for convenience into four groups.

Table 2 shows that the Oxisols initially contained an average of 222 kg/ha (198 lb/acre) of exchangeable K and 189 kg/ha (169 lb/acre) of hot-nitric-acid-extractable K for a total of 410 kg/ha (367 lb/acre) of "available" K. Pangola grass extracted a total of 384 kg/ha (343 lb/acre) of K from these soils over 4 years of continuous cropping. Although many of the individual Oxisols studied evidenced close agreement between total "available" soil K and K removal by Pangola grass, there was no significant correlation between these two parameters for the group (table 3).

After 4 years of cropping the Oxisols contained an average of 64 kg/ha (57 lb/acre) of exchangeable K and 115 kg/ha (103 lb/acre) of hot-nitric-acid-extractable K.

K removal from the Oxisols by Pangola grass was invariably high during the first year (table 4 and fig. 1) averaging 234 kg/ha (209 lb/acre) and exceeding 168 kg/ha (150 lb/acre) with all soils. However, K removal dropped off sharply after the first year (fig. 1) to an average of about 50 kg/ha (45 lb/acre) yearly which was sustained during the subsequent 3 years. This level probably represents the long range K-supplying power to grasses of these Oxisols.

This low K-supplying power of the Oxisols is in line with chemical and mineralogical data which show a fairly low total K content, a low mica content in the clay fraction and strongly weathered K-bearing minerals in the sand fraction (table 5).

Yields during the first year were quite high (table 4) and K content in the forage was low (.72 %). During the next 3 years yields and K content of the forage dropped sharply.

Best correlation with Oxisols, both individually and as a group, was between exchangeable K in the soil at the beginning of the experiment and K extracted during the first year (table 3).

The upland Ultisols, which represented the largest acreages and number of sites studied, initially contained an average of 233 kg/ha (208 lb/acre) of exchangeable K and 155 kg/ha (138 lb/acre) of hot-nitric-acid-extractable K for a total of 388 kg/ha (346 lb/acre) of "available" K (table 2). However, removal of soil K by Pangola grass over 4 years of consecutive cropping totalled 533 kg/ha (476 lb/acre), considerably exceeding "available" soil K content in all these soils (table 2).

TABLE 3.—*Relationship between various soil K values and uptake of this nutrient by Pangola grass growing in pots*

Soil	Exchangeable K at the beginning vs. K extracted during[1] first year	Exchangeable K at end vs. average extracted during[1] last year	Exchangeable K at end vs. K extracted during the fourth[1] year	HNO_3 soluble K at the beginning vs. average K extracted[1] during last 3 years	HNO_3 soluble K at end vs. average K extracted during[1] last 3 years	Total available[2] K vs. total K extracted in[1] 4 years
Humatas clay	.89** *Y* = 107.97 + .582 *X*	.46* *Y* = 36.56 + .612 *X*	.45* *Y* = 21.66 + .601 *X*	.59** *Y* = 61.74 + .123 *X*	.58** *Y* = 65.28 + .149 *X*	.84** *Y* = 267.31 + .55 *X*
Los Guineos clay	.80** *Y* = 92.12 + .658 *X*	Non significant	Non significant	Non significant	Non significant	.65* *Y* = 21.37 + .321 *X*
Alonso clay	.74* *Y* = 164.18 + .314 *X*	Non significant	.70* *Y* = .405 + 1.04 *X*	Non significant	Non significant	Non significant
Dagüey clay	.86** *Y* = 133.33 + .414 *X*	.39* *Y* = 29.80 + .781 *X*	.45** *Y* = 13.61 + .746 *X*	.49** *Y* = 44.41 + .418 *X*	.40* *Y* = 45.97 + .463 *X*	.55** *Y* = 328.78 + .529 *X*
Upland Ultisols	.87** *Y* = 96.73 + .665 *X*	.83** *Y* = 28.99 + .609 *X*	.74* *Y* = 28.33 + .521 *X*	Non significant	Non significant	.81** *Y* = 139.64 + .962 *X*
Coastal plain Ultisols	.96** *Y* = 25.68 + .114 *X*	Non significant	Non significant	.84* *Y* = 25.87 + .115 *X*	.76* *Y* = 27.28 + .163 *X*	.93** *Y* = 82.61 + .824 *X*
All Ultisols	.94** *Y* = 50.30 + .898 *X*	.83** *Y* = 3.90 + .822 *X*	.78** *Y* = 5.12 + .713 *X*	Non significant	.76** *Y* = 23.99 + .327 *X*	.88** *Y* = 55.96 + 1.121 *X*
Catalina clay	.75* *Y* = 144.19 + .308 *X*	Non significant	Non significant	Non significant	.71* *Y* = 34.20 + .112 *X*	Non significant
All Oxisols	.81* *Y* = 108.04 + .487 *X*	Non significant	Non significant	Non significant	Non significant	Non significant
All soils	.90** *Y* = 65.87 + .777 *X*	.81** *Y* = .912 + .836 *X*	.77** *Y* = 2.01 + .726 *X*	Non significant	.64** *Y* = 25.39 + .275 *X*	.73** *Y* = 119.92 + .807 *X*

[1] Extracted (uptake) = *Y*.
[2] Exchangeable + hot nitric acid extraction.

TABLE 4.—*Yield, K content and K removal in Pangola grass growing in pots filled with soil from 181 sites representing 23 Ultisols and Oxisols*

Year	Oxisols		Ultisols of the uplands		Clay Ultisols of the coastal plains		Sandy Ultisols of the coastal plains	
	Kg/ha	*(Lb/acre)*	*Kg/ha*	*(Lb/acre)*	*Kg/ha*	*(Lb/acre)*	*Kg/ha*	*(Lb/acre)*
				Yields (Kg of dry forage)				
1st	32,446	(28,970)	41,294	(36,870)	31,606	(28,220)	19,219	(17,160)
2nd	19,163	(17,110)	28,034	(25,030)	20,350	(18,170)	12,880	(11,500)
3rd	17,830	(15,920)	27,966	(24,970)	18,962	(16,930)	12,118	(10,820)
4th	16,352	(14,600)	24,942	(22,270)	16,789	(14,990)	10,618	(9,480)
				Percent K content of forage				
1st	.72		.63		.73		.47	
2nd	.28		.36		.30		.28	
3rd	.30		.34		.30		.31	
4th	.26		.31		.27		.31	
				Yearly K removal				
1st	234	(209)	260	(232)	231	(206)	91	(81)
2nd	54	(48)	101	(90)	62	(55)	36	(32)
3rd	54	(48)	96	(86)	57	(51)	38	(34)
4th	43	(38)	76	(68)	45	(40)	32	(29)
Total	384	(343)	533	(476)	394	(352)	197	(176)

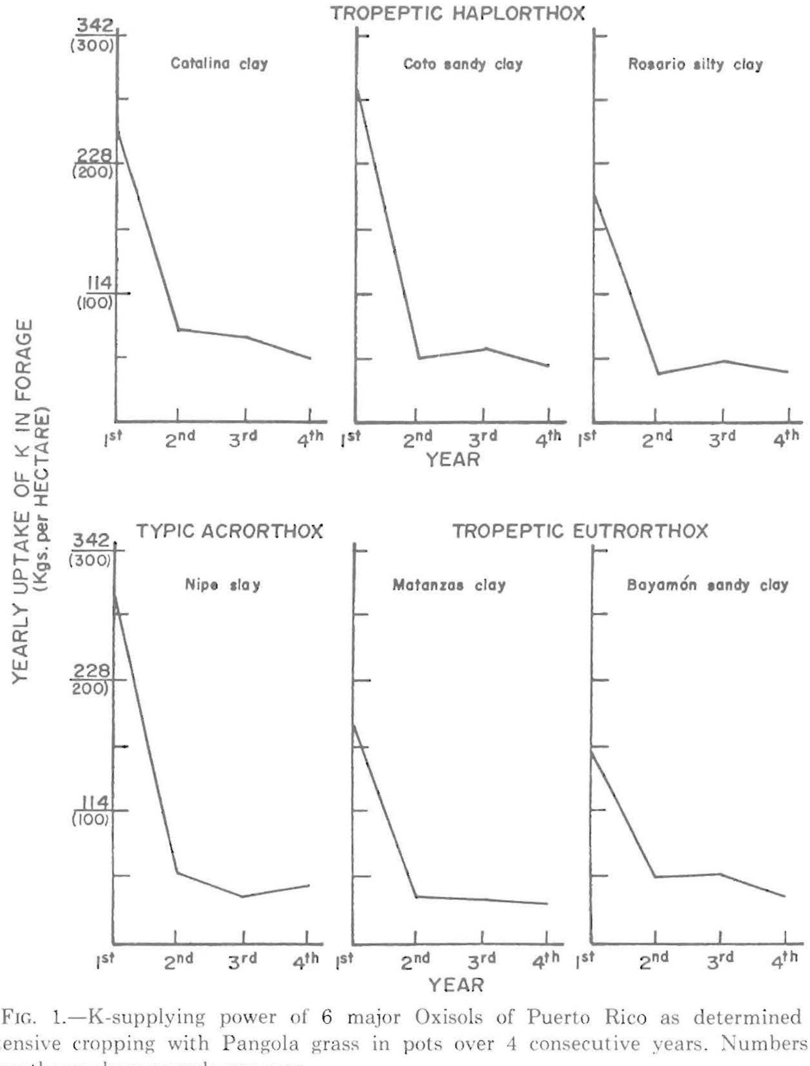

FIG. 1.—K-supplying power of 6 major Oxisols of Puerto Rico as determined by intensive cropping with Pangola grass in pots over 4 consecutive years. Numbers in parentheses show pounds per acre.

After 4 years of cropping, the upland Ultisols contained an average of 88 kg/ha (79 lb/acre) of exchangeable K and 147 kg/ha (131 lb/acre) of hot-nitric-acid-extractable K.

These soils released large quantities of K to the grass during the first year averaging 260 kg/ha (232 lb/acre) (table 4 and fig. 2) and exceeding 224 kg/ha (200 lb/acre) in all but one soil. However, K removal dropped off sharply after the first year to an average of about 90 kg/ha (80 lb/acre) yearly which was sustained during the subsequent 3 years.

TABLE 5.—*Some physical and mineralogical characteristics of the major Ultisols and Oxisols studied*[1]

Soil series	Classification	Sand	Silt	Clay	Total K	Predominating clay minerals	Predominating K minerals in sand fraction
		%	%	%	%	%	
				Ultisols			
Humatas	Typic Tropohumults	6.7	38.2	55.1	.28	Mi.-7,[2] Ver-8 Kaol. 44 Amor. 15-F_2O_3-17	Orthoclase-microcline
Dagüey	Orthoxic Tropohumults	9.7	53.7	36.6	.32	Mi.-4, Ver-13 Kaol. 46, Amor. 27 Qtz. 2, F_2O_3-8	Primarily altered orthoclase; mica books are abundant
Los Guineos	Epiaquic Tropohumults	5.8	40.4	53.8	.25	Mi.-4, Ver-5 Kaol. 45, Amor. 19 Gib. 3 Qtz. 2, Gib. 3	Strongly altered, orthoclase; flakes of biotite and muscovite
Alonso	Orthoxic Tropohumults	20.9	55.4	23.7	.84	Mi.-16, Mont. 17 Ver.-10, Kaol. 31 Amor. 19	Abundant biotite muscovite books
				Oxisols			
Coto	Tropeptic Haplorthox	42.0	33.5	24.5	.12	Mi.-3, Ver.-7 Kaol. 43 Amor. 16	Altered feldspars; mafics are biotite books strongly weathered
Bayamón	Tropeptic Eutrorthox	49.4	30.6	20.0	.12	Not determined	Same as above

Nipe	Typic Acrorthox	7.1	44.1	48.8	.18	Mi.-2, Ver.-6 Kaol. 40	Abundant micas; mafics as high as 30-50%
Rosario	Tropeptic Haplorthox	23.7	62.9	13.4	.07	Mi.-2, Mont. 32 Ver. 11, Kaol. 25 Amor. 11	Micas; mafics—20-40%
Matanzas	Tropeptic Eutrorthox	20.6	43.4	36.2	.23	Not determined	Altered biotite books

[1] Unpublished data provided by Dr. Michael Weaver, Assistant Professor of Soil Science, Cornell University, Ithaca, N. Y.
[2] Mi. = Mica, Ver. = Vermiculite, Kaol. = Kaolinite, Amor. = Amorphous, Qtz. = Quartz, Gib. = Gibbsite, Mont. = Montmorrillonite.

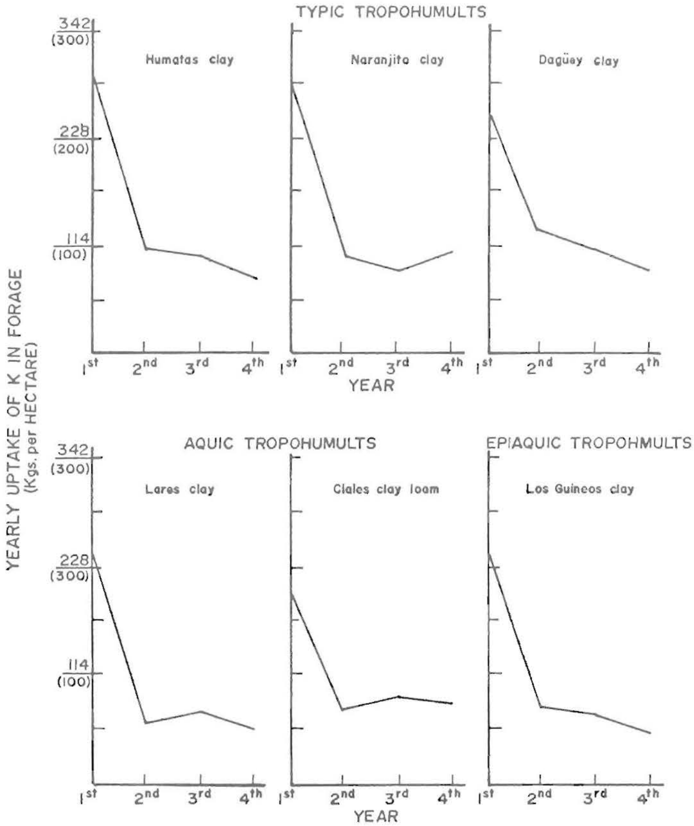

FIG. 2.—K-supplying power of 10 major Ultisols of the uplands of Puerto Rico as determined by intensive cropping with Pangola grass in pots over 4 consecutive years. Numbers in parentheses show pounds per acre.

The upland Ultisols have a much higher total K content than the Oxisols; micas are more abundant in the clay fraction; the K bearing minerals in the sand fraction are more abundant and less weathered (table 5). This explains why the long range K supplying power of the upland Ultisols is higher (90 kg/ha vs. 50 kg/ha) than that of the Oxisols.

Forage yields in the upland Ultisols also were considerably higher than in the Oxisols, but K content of the forage was low in both cases.

Table 3 shows that the best correlation with the upland Ultisols, either individually or as a group, was obtained between exchangeable soil K at start of the experiment and K extracted by Pangola grass during the first year.

The coastal plain clay Ultisols initially contained an average of 168 kg/ha (150 lb/acre) exchangeable K and 167 kg/ha (149 lb/acre) of

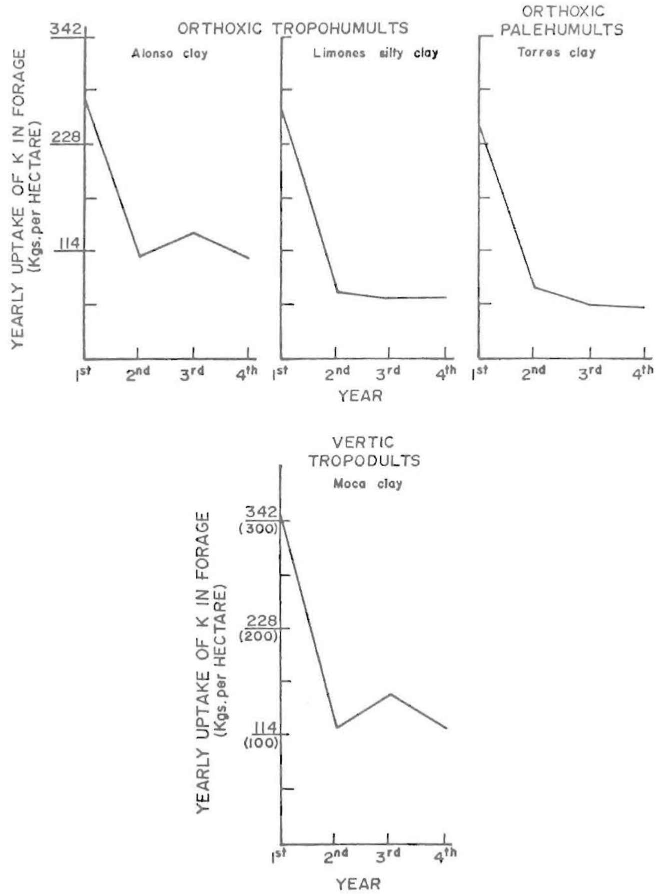

Fig. 2.—*Continued*

hot-nitric-acid-soluble K for a total of 335 kg/ha (299 lb/acre) of "available" K; removal of K from these soils by Pangola grass over 4 years of cropping averaged 394 kg/ha (352 lb/acre) (table 2).

After 4 years of cropping these soils contained an average of 65 kg/ha (58 lb/acre) of exchangeable K and 92 kg/ha (82 lb/acre) of hot-nitric-acid-extractable K.

During the first year of cropping the coastal plain clay Ultisols released an average of 230 kg/ha (206 lb/acre) of K (table 4 and fig. 3) dropping to an average of about 56 kg/ha (50 lb/acre) during the next 3 years, which probably represents their long range K-supplying power to grasses. No mineralogical data were obtained for this group of soils.

The sandy coastal plain Ultisols contained an average of only 53 kg/ha (47 lb/acre) of exchangeable K and 109 kg/ha (97 lb/acre) of hot-nitric-

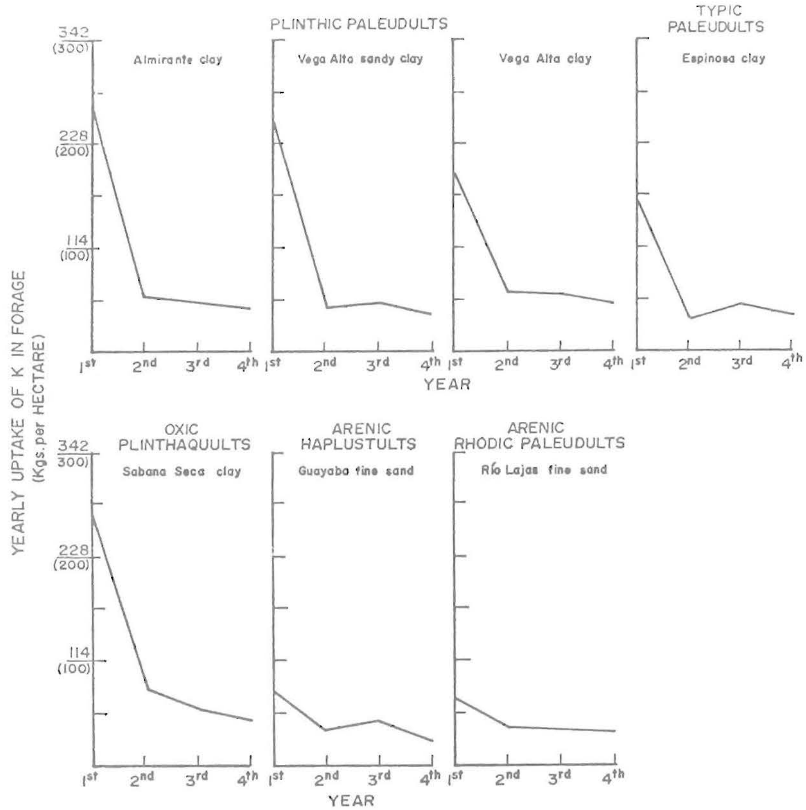

FIG. 3.—K-supplying power of 7 major Ultisols of the coastal plains of Puerto Rico as determined by intensive cropping with Pangola grass in pots over 4 consecutive years. Numbers in parentheses show pounds per acre.

acid-extractable K for a total of 161 kg/ha (144 lb/acre) of "available" K; Pangola grass removed a total of 197 kg/ha (176 lb/acre) of K during 4 years of cropping (table 2).

After 4 years of cropping these soils contained an average of 60 kg/ha (54 lb/acre) exchangeable K and 69 kg/ha (62 lb/acre) of hot-nitric-acid-extractable K.

The sandy coastal plain Ultisols released an average of 90 kg/ha (81 lb/acre) of K during the first year (table 4 and fig. 3) levelling off to about 35 kg/ha (31 lb/acre) yearly during subsequent years, which probably represents their long range K-supplying power to grasses. These soils had the lowest K-supplying power and forage yields.

Forage yields (table 4) and K-supplying power (figs. 1,2,3) of all soils dropped off sharply after the first year and only slightly thereafter. K content of the forage (table 4) also dropped off sharply from an average of .66% during the first year to an average of .31% during the 3 subsequent years.

It is surprising that relatively high yields of forage were obtained with such low K contents in the forage and that no K deficiency symptoms were evident. In the field, Pangola grass exhibits severe K deficiency symptoms and yields drop off sharply when the forage contains less than about 1% K.[4]

As there is no apparent explanation for this wide discrepancy between the levels of K required by Pangola grass for high production in pots and in the field, further investigation is needed.

Figure 4 shows the close relationship between exchangeable K in the five major soils studied and K extracted by Pangola grass during the first year of cropping. Therefore, exchangeable K values offer an excellent

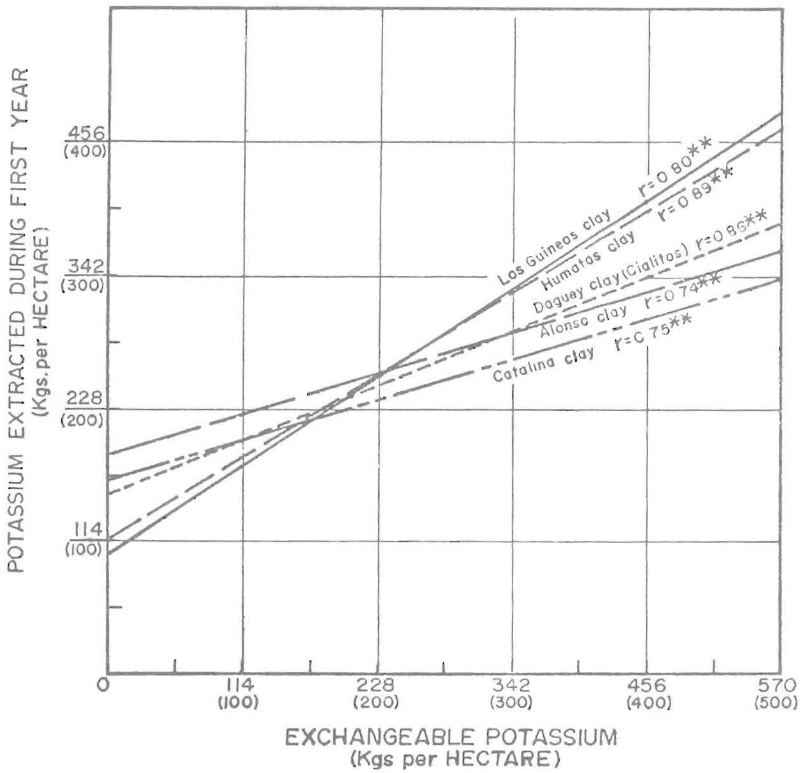

FIG. 4.—Relationship between exchangeable K in four major Ultisols and one major Oxisol of Puerto Rico and K removal by Pangola grass growing in pots over a 1-year period. Numbers in parentheses show pounds per acre.

estimate of the K-supplying power to grasses of these soils during the subsequent years and are valuable in making fertilizer recommendations.

Table 3 summarizes the relationships between soil K values and removal of K by Pangola grass. With all soils a close relationship (r = .75 to .94) existed between initial exchangeable soil K content and K removal by Pangola grass over the first year of cropping.

Exchangeable K in the soil at the end of the experiment and amount of K extracted during the last 3 years of cropping was closely related with the averages for all Ultisols and the upland Ultisols (r = .83), as well as for all soils (r = .81).

The relationship between exchangeable K at the end of the experiment and K extracted during the 4th year of cropping was closely related only with the upland Ultisols (r = .74), all Ultisols (r = .78), Alonso (r = .71), and all soils (r = .77).

The relationship between hot-nitric-acid-soluble K at the beginning of the experiment and K extracted during the last 3 years was close only with the coastal plain Ultisols (r = .84).

The relationship between hot-nitric-acid-extractable K at the end of the experiment and K extracted during the last 3 years was close only with all Ultisols combined and the coastal plain Ultisols (r = .76), and with Catalina clay (r = .71).

There was a significant relationship between total available K and total K extracted by Pangola grass over 4 years of cropping with all soils and groups except the Oxisols and Catalina and Alonso soils.

RESUMEN

Se determinó la capacidad de 17 Ultisoles y 6 Oxisoles para suplir potasio a las cosechas. Se emplearon 181 tiestos, cada uno conteniendo 11.4 kg. de suelo (25 libras) representativos de las localidades donde se tomaron las muestras. Se utilizó la yerba Pangola como cosecha supliéndole todos los nutrimentos excepto el potasio. Durante cuatro años se cosechó el forraje cada 60 días, determinándose su rendimiento y la cantidad de potasio extraída por la yerba.

Durante el primer año los grupos de suelos suplieron las siguientes cantidades de potasio: 1) los Oxiosles, 234 kg./Ha. (209 lb/acre); 2) los Ultisoles de la altura, 260 kg./Ha. (232 lb/acre); 3) los Ultisoles arcillosos de las llanuras costaneras, 230 kg./Ha. (206 lb/acre); 4) los Ultisoles arenosos de las llanuras costaneras, 90 kg./Ha. (81 lb/acre).

Durante los siguientes tres años estos suelos suplieron a la yerba Pangola las siguientes cantidades de potasio al año: 1) los Oxisoles, 50 kg./Ha. (45 lb/acre); 2) los Ultisoles de la altura, 90 kg./Ha. (80 lb/acre); 3) los Ultisoles arcillosos de los llanos costaneros, 55 kg./Ha. (49 lb/acre); 4) los Ultisoles arenosos de los llanos costaneros, 35 kg./Ha. (31 lb/acre).

Se obtuvieron correlaciones significativas entre la cantidad de potasio extraído por la yerba y las cantidades determinadas por métodos químicos La relación entre el potasio intercambiable al inicio del experimento y la cantidad de este nutrimento extraído por la Pangola durante el primer año fue la más consistente. El valor del potasio intercambiable, por tanto, proporciona un estimado excelente de la capacidad del suelo para suplir potasio a las yerbas durante el año siguiente al de la toma de la muestra analizada.