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1. India's Resources in Mineral Fertilisers. By Sir Edwin Pascoe.
1929. (No. 42.) J:24.2 F9 1-24 pp.
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X: 964.2.N3 G7
X: 9P1, N19 (V2) F9
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X: 9P1, N19 (V2) G0
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H7551.2 G5
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No. 42.

**INDIA'S RESOURCES IN MINERAL
FERTILISERS.**

BY

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The Government of India desire it to be understood that the statements made and the views expressed in this bulletin are those of the author himself.

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No. 42.]

1929

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INDIA'S RESOURCES IN MINERAL FERTILISERS.

This article is the result of a memorandum drawn up for the use of the Royal Commission on Agriculture in 1927. It makes no pretence to deal with the agricultural side of the subject but is merely a brief sketch of India's resources in nitrogen, potash, phosphorus and other elements and compounds concerned in the treatment and welfare of soils. The statistics have been brought up to date so far as this is possible.

I.—NITRATES AND AMMONIA (INCLUDING GAS-LIME AND CYANAMIDE).

Nitrate of Soda (Chili Saltpetre).

No nitrate of soda is produced in India. The following are the imports into India for the past eight years* :—

	203 tons valued at Rs.	60,480
1920-21	130 "	38,821
1921-22	1,442 "	3,38,540
1922-23	1,945 "	4,07,678
1923-24	3,977 "	7,66,314
1924-25	3,963 "	7,13,645
1925-26	6,070 "	10,11,030
1926-27	7,458 "	11,43,615

The increase in imports from 1922 is very noticeable.

* Arranged under Calendar years the figures are :—

	Tons.
1921	241
1922	1,161
1923	1,747
1924	3,360
1925	4,053
1926	6,528
1927	7,748
1928	8,332

Nitrate of Potash.

The fact that, weight for weight, sodium nitrate contains 7 per cent. more nitric acid than the potassium salt, is balanced by the fact that the potash of the latter has valuable fertilising qualities whereas soda has little importance from an agricultural point of view. The conditions necessary for the natural formation of potassium nitrate are :—

- (i) a continuous supply of nitrogenous organic matter,
- (ii) the presence of potash.
- (iii) a climate favourable to the growth and action of nitrifying bacteria,
- (iv) drainage traps and meteorological conditions suitable for the efflorescence of the salt at or near the surface.

These conditions are fulfilled in various parts of India, typically in the Bihar section of the Gangetic plain, where the population in some parts reaches the high figure of over 600 to the square mile; this population is engaged mostly in farming and agriculture, and is thus accompanied by a high proportion of domestic animals supplying an abundance of organic nitrogen. The requisite potash is derived from the staple fuel, which consists very largely of cow-dung and wood. With a mean temperature of 78°F. during a large part of the year, and a comparatively high humidity combined with a low diurnal range in temperature, conditions in the Bihar plain are unusually favourable for the growth of nitrifying organisms. Finally, with a period of continuous surface desiccation following a small rain-fall, the sub-soil water, brought to the surface by capillary action in the soil, leaves an efflorescence of which potassium nitrate forms a conspicuous proportion.* Similar conditions obtain in parts of Egypt. The Saltpetre industry in India flourished especially during the days of the American Civil War when the salt was an essential ingredient of all explosives and when India practically held a monopoly of its production.†

The houses of Indian villages consist for the most part of mud and, as a consequence, frequently tumble down and have to be renewed. The village site thus becomes gradually raised, and as the floors of the houses are frequently made of mud and cow-dung, there is built up a nitrogenous deposit, which is reinforced by other forms of animal refuse and to which are added the wood ashes of innumerable fires. The decaying refuse undergoes nitrification, and the product drains from these raised village sites into lower levels and separates out as an efflorescence consisting largely of sodium chloride, sodium sulphate and nitrates of potash and magnesium.

The production of saltpetre has formed an important industry in India from very early times. The accumulations in some of the old village sites are the result of hundreds of years.

The earths from which the crude saltpetre is extracted contain sometimes as much as 29 per cent., sometimes as little as 1 per cent., but not often more

* W. A. K. Christie. *Rec. Geol. Surv. Ind.*, Vol. LVII, p. 276.

† P. C. Tallents. *Census of India, 1921, Vol. VII, pt. 1, p. 258.*

than 5 per cent. of nitrate. The process of extraction is described by C. M. Hutchinson.* Wood ashes are added to decompose any calcium nitrate in the earth, and the approximate proportions of the various salts in the drainage liquor are :—

	Per cent.
Sodium chloride	15.25
Potassium nitrate	7.24
Potassium chloride	0.40
Magnesium chloride	0.20
Calcium chloride	0.10
Calcium sulphate	0.10
Magnesium sulphate	0.10

On evaporation sodium chloride first crystallizes out, and the nitrate is obtained later. The crude saltpetre varies greatly in composition, and always contains a considerable amount of sodium chloride. The following are analyses of high and low grade crude saltpetre :—

	High grade.	Low grade.
Potassium nitrate	66.07	26.86
Magnesium nitrate	2.54	12.24
Sodium chloride	21.84	34.80
Sodium sulphate	3.65	11.20
Insoluble matter	0.90	1.40
Water	5.00	13.50

Some of this crude saltpetre (*kuthea*), which may contain from 30 to 50 per cent. of foreign matter, is used as a fertiliser but most of it is sent to refineries for the manufacture of gun-powder. The crude earths (*lona mati*), from which this saltpetre is extracted by lixiviation, are also used on the spot for manure purposes in north-western India, especially in the upper Doab where the people are well-to-do, and in parts of Bihar. According to Mukerji† it has been found more satisfactory to use nitrate manure in a comparatively pure form.

The typical conditions for the formation of nitrate in the Bihar plain are repeated in the Punjab and the United Provinces. These two areas are, in fact, reported to turn out almost as much as Bihar. Tables 1 and 2 give the official returns for saltpetre produced and exported for the years 1919-1924‡ and 1919-1928, respectively. The production figures cannot be looked upon as giving a true index of the extent of manufacture, the figures for 1920, for instance, shewing an excess of exports over production, not to be explained by invoking accumulated stocks. One thing the figures do shew is a continuous decline in production since 1919, the figures for 1923 and 1924 being the lowest for at least eighty years; all the provinces shared in this reduction.

* *Agri. Res. Inst., Pusa.*—Bull. No. 68 (1917).

† N. G. Mukerji.—“*Indian Agriculture*” (1901).

‡ Production returns for years subsequent to 1924 are not available.

TABLE 1.—Quantity and value of Saltpetre produced in India during the years 1919 to 1924.

	1919.		1920.		1921.		1922.		1923.		1924(c).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Tons.	Rs.	Tons.	Rs.	Tons.	Rs.	Tons.	Rs.	Tons.	Rs.	Tons.	Rs.
Bihar (refined)	5,044	11,66,268	3,880	12,24,221	4,277	13,96,264	2,009	5,05,494	1,623	3,86,243	1,820	5,10,469
Bihar (kutha)	2,165	3,82,970	1,855	5,08,415	2,681	5,86,464	1,770	2,61,423	1,360	1,98,978	1,384	2,98,944
Central India	48	4,185	44	2,596	2	450	16	3,780	18	4,030	14	2,951
Punjab	5,662	17,13,277	6,548	25,82,376	4,339	19,04,298	5,039	18,93,015	3,056	9,76,860	3,315	11,45,811
Rajputana	180	46,005	217	63,970	229	82,752	182	46,487	..	..	24	7,020
United Provinces	6,616	17,82,739	4,980	15,26,961	4,366	13,85,340	2,657	8,12,796	2,498	6,80,244	1,829	5,25,497
Bengal . . . . .	..	..	..	..	..	..	..	..	23	8,293(a)	44	10,791(a)
Madras(b) . . . . .	..	..	..	..	..	..	..	..	138	38,186 (a)	112	32,554(a)
TOTAL	19,715	80,95,444	16,874	59,08,539	15,894	53,55,478	11,673	35,22,995	8,716	22,92,834	8,542	25,34,037

(a) Estimated

(b) Production for the official years 1923-24 and 1924-25.

(c) Owing to the withdrawal of restrictions on the manufacture of saline substances in India, production figures subsequent to 1924 are no longer available.

TABLE 2.—Distribution of Saltpetre exported during the years 1919 to 1928.

	1919.			1920.			1921.			1922.			1923.		
	Quantity.	Value.	Per cent. of total quantity.	Quantity.	Value.	Per cent. of total quantity.	Quantity.	Value.	Per cent. of total quantity.	Quantity.	Value.	Per cent. of total quantity.	Quantity.	Value.	Per cent. of total quantity.
	Tons.	Rs.		Tons.	Rs.		Tons.	Rs.		Tons.	Rs.		Tons.	Rs.	
United Kingdom	6,695	23,58,750	38.9	6,790	25,26,420	30.7	4,415	15,10,773	34.2	2,545	7,42,310	23.0	806	2,92,309	10.7
Ceylon	2,987	7,60,440	17.3	4,242	11,12,380	19.2	810	2,25,403	6.4	8,100	7,46,349	28.1	2,751	7,00,637	34.1
Hongkong	2,838	7,47,050	13.5	1,404	4,95,590	6.3	8,262	14,74,118	25.3	2,570	12,60,400	23.4	1,207	5,68,029	16.1
Japan	507	2,07,330	3.0	115	35,300	0.5	..	..	..	..	..	..	..	..	..
Mauritius and dependences . . .	1,077	5,84,630	11.5	4,236	16,55,450	19.1	2,073	10,46,876	21.1	1,311	4,59,461	11.9	2,355	8,35,998	29.9
Straits Settlements including Labuan .	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
United States of America . . .	1,205	3,86,470	7.5	4,835	13,25,030	19.6	750	2,32,550	5.3	218	61,438	2.0	..	..	..
Other countries	1,426	4,92,190	8.3	1,012	3,47,230	4.6	675	3,03,722	6.2	1,200	5,04,032	11.6	798	3,09,000	9.9
TOTAL	17,220	55,40,760	100.0	22,134	75,27,400	100.0	12,894	47,93,472	100.0	11,043	37,77,650	100.0	8,087	27,06,582	100.0

1929.]

India's Resources in Mineral Fertilisers.

TABLE 2.—*Distribution of Saltpetre exported during the years 1919 to 1928—contd.*

	1924.			1925.			1926.			1927.			1928.		
	Quantity.	Value.	Per cent. of total quantity.	Quantity.	Value.	Per cent. of total quantity.	Quantity.	Value.	Per cent. of total quantity.	Quantity.	Value.	Per cent. of total quantity.	Quantity.	Value.	Per cent. of total quantity.
	Tons.	Rs.		Tons.	Rs.		Tons.	Rs.		Tons.	Rs.		Tons.	Rs.	
United Kingdom . . .	799	2,30,014	9.5	848	2,36,112	13.4	752	1,80,044	15.22	666	1,54,074	10.83	811	1,95,348	18.11
Ceylon	3,426	8,62,689	40.9	3,549	8,76,326	55.9	3,097	7,16,452	62.68	4,320	9,42,667	70.22	3,132	6,04,892	69.94
Hongkong	1,780	7,97,507	31.2	1,068	4,72,040	16.8	564	2,39,440	11.42	103	92,300	1.68	..	..	..
Japan . . . . .	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Mauritius and dependences . .	1,810	6,49,988	31.5	441	1,72,724	6.9	97	31,593	1.96	693	2,12,907	11.27	304	1,14,630	6.79
Straits Settlements, including Labuan.	240	1,08,192	3.9	233	90,743	3.7	278	96,333	5.62	193	57,548	3.14	143	44,427	3.19
United States of America . . .	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Other countries	380	1,52,323	4.0	210	1,15,296	3.3	153	60,173	3.10	176	62,170	3.86	88	40,637	1.97
TOTAL	8,885	27,99,313	100.0	6,349	19,63,301	100.0	4,941	13,24,540	100.00	6,151	15,22,666	100.00	4,478	10,00,034	100.00