

## The Influence of Manuring on the Phytin Phosphorus Content of Grains.

by

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The value of the cereal grains for human nutrition is governed to a large extent by the nature and amount of the protein and also the form of phosphorus synthesised by the plants. It has been known for a long time that a large proportion of the total phosphorus present in cereals and vegetables may be present in the form of Phytin, the calcium magnesium salt of inositol-hexaphosphoric acid. But, there is no agreed opinion among the scientists regarding its usefulness. Thus Starkenstein (1910), Hutchison and Mottram (1933), held that the compound was useful while Plimmer (1913) showed that it was not utilized by human beings. More evidence chiefly due to the studies of Mecance and Widdowson (1935), indicated that the phosphorus of phytin was not available to a great extent to the human system. So studies were undertaken to see how far the different forms of phosphorus occurring in the grains varied with the application of different kinds of fertilisers, both singly and in combinations, and the results are furnished in this paper.

**Materials and Methods:** Samples of cholam grains were obtained from the Old and New Permanent Manurial experimental plots at Coimbatore. In the Old permanent Manurial plots crops are grown under rainfed conditions under the following manurial treatments: (1) No manure (2) N (3) NK (4) NP (5) NPK (6) PK (7) K (8) P (9) Cattle manure CM (10) Cattle manure residual CMR. N was applied as ammonium sulphate at 1 cwt, P as single super at 3 cwt and Potash as Potassium sulphate at 1 cwt per acre. Cattle manure is applied at 5 tons per acre. In the Cattle Manure Residual plot the manure was applied for a few years and then left off. In the new Permanent manurials treatments are similar to those in the old Permanent Manurials except for the fact that another series of plots (Western series) received in addition a basal dressing of cattle manure at 2000 lb. per acre. All the plots in New Permanent Manurial are irrigated.

The grains were analysed for moisture, total and phytin phosphorus. Total Phosphorus was estimated by the colorimetric stannous chloride methods (Dickman and Bray 1940) in the wet digest of an aliquot of the grain (Piper 1947). Phytin was extracted by the method of Mecance and Widdowson (1935) and the Phosphorus determined as in the case of total Phosphorus.

**Results and Discussion :** The results are given in the table below. Table I and II.

*Total phosphorus:* The addition of Phosphorus to the soil as fertilizer has increased the total Phosphorus content of the grains in the Old Permanent Manurial but the increase as compared with "no manure" is not marked in the New Permanent Manurial. The total Phosphorus percentage varied from a minimum of 0.3701 in the case of NK treatment to 0.6509 percent in PK treatment in the Old Permanent Manurial plots. Surprisingly the PK treatment in the Western series of New Permanent Manurial gave the lowest value of 0.5325% of Phosphorus.

*Phytin P:* This form of Phosphorus varied from 0.1409 percent in the Potash treatment to 0.278% in the case of PK in the Old Permanent Manurial plots. The percentages of Phytin Phosphorus were generally higher in the grains from the New Permanent Manurial plots, the variations ranging from 0.1854% in PK to 0.3701% in No manure treatment in the Western series. Generally the Phytin Phosphorus appeared to increase or decrease with the total Phosphorus percent of the grains. The increase in the percentages in general of total and Phytin Phosphorus in the grains due to the application of Phosphatic fertilizer is in agreement with the observations of Srivastava *et al.* (1955) in the case of wheat. The increase in the percentage of Phytin Phosphorus in the Phosphorus treatments over no manure in the Old Permanent Manurial and the absence of such a marked difference in the Western series of New Permanent Manurial indicate that irrigation may promote greater amount of synthesis of the Phytin Phosphorus than rainfed conditions apart from the possible difference due to the varieties grown in the different experiments.

*Ratio of Phytin Phosphorus to Total Phosphorus :* "No manure" has given a ratio of 0.38 while Nitrogen, NPK and PK and also CMR have given nearly identical values (viz. 0.44) in the Old Permanent Manurial. The highest ratio of 0.48 has been given by NK in the same experiment. The absence of much difference between Phosphorus and non phosphorus plots is due to the increase of both total and Phytin Phosphorus in the Phosphorus treatments. The ratios are generally higher in the New Permanent Manurials plots, the variations ranging from 0.36 in the case of Nitrogen to 0.81 in the case of Phosphorus in the Western series. The general higher level of the ratios in the New Permanent Manurial would appear to indicate greater proportion of phytin in the synthesis of phosphorus compounds. As the cholam varieties grown in the two sets of experiments are different (*Periamanjil* cholam in the Old Permanent Manurial and Summer Cholam in the New Permanent Manurial), differential synthesis of Phytin due to this cause is also possible to some extent.

*Non-phytin Phosphorus:* This fraction was calculated by subtracting the phytin from the total phosphorus. It ranged from 0.1935% in NK treatment to 0.4137% in NP treatment in the Old Permanent Manurial Plots. Cattle manure gave only 0.3548% and NPK treatment 0.2479%. In the New Permanent Manurial plots, the percentage ranged from 0.0581 in PK treatment to 0.2650 in NPK treatment in the Western series. Cattle manure registered only 0.1482% in the same series.

Thus, if non-phytin forms of Phosphorus are taken as indicative of the nutritive value of the grains Potash, NP, Phosphorus, PK and CM would appear to be the descending order of merit of the treatments in the rainfed crop. Under irrigated conditions NPK, NP, N, K and CM would appear to be the order of merit. From the point of nutritive value of phosphorus in grain, there does not appear to be any support for the view that cattle manure is superior to the inorganic fertilizers.

**Summary and Conclusions:** Samples of cholam grains got from the Permanent Manurial plots were analysed for total and Phytin phosphorus. The following conclusions were drawn from the determinations.

(1) The application of phosphatic fertilizer leads to an increase in the total and phytin forms of phosphorus, the variations as compared with the control being more in the Old Permanent Manurial plots (rainfed).

(2) Irrigation appears to increase the proportion of Phytin Phosphorus in the grains as compared with rainfed crops. There is also the possibility of differential synthesis of Phytin due to differences in the varieties grown in the two sets of experimental plots.

(3) If non-phytin form of Phosphorus is taken as the criterion of the nutritive value of the grain, CM does not appear to be superior to Phosphorus, PK and NP under dry conditions while under irrigated conditions NP and NPK are better than CM while Phosphorus alone is inferior to the latter. It is evident therefore that Phosphorus has to be combined with N and K for best quality grains containing more of the non-phytin Phosphorus.

TABLE I  
*Results of Analysis of Cholam Grains from the Permanent Manurial Experiments for different forms of Phosphorus (on oven dry basis)*

Plot No.	Treatment	Lab. No.	Old Permanent Manurials			
			Total P %	Phytin P %	Non-phytin P% (By difference)	Phytin P Total P
1	No manure	536/1956-57	0.4695	0.1760	0.2935	0.38
2	N	537	0.3922	0.1685	0.2237	0.43
3	NK	538	0.3701	0.1766	0.1935	0.48
4	NP	539	0.5940	0.1803	0.4137	0.30
5	NPK	540	0.4425	0.1046	0.2479	0.44
6	PK	541	0.6509	0.2780	0.3729	0.43
7	K	542	0.5555	0.1409	0.4146	0.25
8	P	543	0.6434	0.2440	0.3994	0.38
9	CM	544	0.5719	0.2171	0.3548	0.38
10	CMR	545	0.4689	0.2039	0.2650	0.44



TABLE II

*Results of Analysis of Cholam Grains from the Permanent Manurial Experiments for different forms of Phosphorus (on oven dry basis)*

Plot No.	Treatment	Now Permanent Manurial (Western series)				
		Lab No.	Total P%	Phytin P%	Non-phytin P%	Phytin P Total P
1	No manure	150/1955-56	0.4628	0.3701	0.0927	0.80
2	N	151	0.3780	0.1374	0.2406	0.36
3	NK	152	0.4926	0.2881	0.2045	0.58
4	NP	153	0.5325	0.2817	0.2508	0.53
5	NPK	154	0.4749	0.2099	0.2050	0.44
6	PK	155	0.2435	0.1854	0.0581	0.76
7	K	156	0.4161	0.2052	0.2109	0.49
8	P	157	0.4369	0.3568	0.0801	0.81
9	CM	158	0.3430	0.1948	0.1482	0.57
10	CMR	159	0.3418	0.2240	0.1178	0.66

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## Announcement

A conference of Upper Subordinates of the Eastern Region will be held at Trichy on 22nd June 1958. All Upper Subordinates of South Arcot, Tanjore and Trichy are requested to attend the Conference. Delegates from other districts are also invited.

There will be a General Body Meeting of the State Association on 22nd June at Trichy. Resolutions to be discussed at this Meeting may kindly be sent in duplicate to Sri T. R. Padmanabha Rao, Special Agricultural Demonstrator, Manapparai P. O., Trichy District, before 10th June 1958.

There will also be a benefit performance at Trichy on 22nd June to raise funds for the State Association.

Your co-operation and help are earnestly solicited.

*Deputy Secretary,  
Upper Subordinates' Association,  
Trichy District.*