

## Crop Residues of Paddy and their Manurial Value

by

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**Introduction:** Information on the amount of organic residues left by a crop after harvest is not available for many crops of the State. This information is important, as crop residues contribute considerably to the soil organic matter content and also add nitrogen and other plant nutrients to the soil. The nitrogen in the organic matter is in the form of humus protein which is resistant to microbiological attack but ensures a steady stream of ammonia and nitrate during the growing season of a crop. The phosphorus compounds in humus are also available gradually by the decomposition of humus; this organic phosphorus is about as available to plants as inorganic phosphorus. Even in paddy, which is an important crop of the State, no reliable data are available anywhere in literature. Therefore, an attempt was made to gather this information on paddy, using CO.25 variety.

**Material and Methods:** In an experimental field, soon after the harvest of paddy, an unit area of one square yard was marked with ropes and the roots and stubbles in that area were dug out and collected along with the earth so as not to lose the finer roots. The stubbles were washed thoroughly to remove the soil, dried in the sun and weighed. Samples were taken similarly from four other plots and finally subjected to analysis. The yield of grain and straw of the respective plots from which roots and stubbles were collected were also recorded. The plant materials were analysed for nitrogen, phosphoric acid and potash.

**Results:** The yield of grain and straw of the different plots with the estimated quantity of stubbles and roots left behind by a crop is given in Table I.

The proportion in which the different parts of the crops are obtained is given as percentages in Table II. The nitrogen, phosphoric and potash contents of grain, straw, stubbles and roots are given in Table III. The chemical composition of the various parts are given in Table IV. The quantity of plant nutrients removed by the crop from the soil, through grain and straw is given in Table V. The quantity of crop residue and their manurial values

in pounds per acre are given in Table VI. The quantity of nutrients removed by grain and straw and those left behind in stubbles and roots are given in Table VII.

Since green plants synthesise organic matter out of inorganic elements and simple compounds obtained partly from the atmosphere and partly from soil, they have a part in augmenting the organic matter content or humus of the soil. For it has been estimated that 85-99 percent of organic matter of plants is formed from the carbon dioxide of the air. Therefore, the crop residues such as roots and stubbles, help to increase the humus content of the soil. It is seen from the study that a paddy crop yielding about 4080 lb. of grain and 6880 lb. of straw per acre leaves about 2460 lb. of residues in the form of stubbles and roots. This works out to 35.81 percent on the straw yield or 24.55 percent on the total aerial portion harvested as grain and straw. If computed on the whole plant, inclusive of roots, the quantity of roots and stubbles comes to 18.37 percent or about a fifth of the total yield of grain and straw. The quantity of roots and stubbles is likely to vary according to the variety, seedrate used, distance between plants, manuring and other agronomic practices inclusive of the method of harvesting, which varies widely from place to place.

From the analytical data (Table II) it will be seen that there is a wide variation in the three major plant food elements namely, nitrogen, phosphoric acid and potash in the different parts of paddy plant. Highest amounts of nitrogen and phosphoric acid are found in the grain while potash is highest in the straw. The potash content of the grain is the lowest. The stubbles and roots contain the lowest amount of nitrogen while the phosphoric acid content is better than that of the straw. Potash content of stubbles and roots is fairly high.

The proportion of stubble to root was found to be 1:1.45. The composition of stubbles and roots are given in Table III. Stubbles contain more nitrogen, while roots contain more of phosphoric acid and potash.

The amount of plant food elements removed by a crop from the soil depends upon the composition of the grain, straw, roots and stubbles. It is found in the present study that a crop of paddy giving 4080 lb. of grain and 6880 lb. of straw removes from the soil about 88 lb. of nitrogen, 43 lb. of phosphoric acid and 112 lb. of potash.

The quantity of these elements left behind in the crop residue is about 11 lb. of nitrogen, 15 lb. of phosphoric acid and 16 lb. of potash. The total organic carbon added to the soil is about 534 lb.

It has been established that carbon : nitrogen ratio in humus is usually from 9 : 1 to 12 : 1. When straw containing a large amount of carbon and very little of nitrogen is incorporated into the soil, only a small part of the carbon is utilised by the soil microorganisms and the major portion of the carbon escapes as carbon dioxide. If an average carbon : nitrogen ratio of 10 : 1 is assumed, the amount of carbon of 534 lb. left in the crop residue would require 53.4 lb of nitrogen to form humus. The residue contains only about 9.7 lb. of nitrogen and therefore, about 45 lb. of nitrogen will have to be supplemented. This amount of nitrogen is necessary, as the high amount of lignin, contained in these crop residues that are transformed into humus, require a greater quantity of nitrogen for a larger percentage of conversion of dry matter into humus. If the requisite quantity of nitrogen is not available there will be a partial nitrogen starvation owing to the activity of micro-organisms that will draw up the available nitrogen of the soil. Such a condition would lead to crop failure.

Instances of crop failures are not wanting and the failure of cotton following *Irungu cholam* in the Tirunelveli tract is a good example. The failure of cotton was attributed to several causes but finally the studies by Menon and Menon revealed that the reduction in yield of cotton (by about 16 percent) was caused by the poor nitrogen supply, as the available soil nitrogen was immobilised by the activity of the micro-organisms which acted upon the cholam stubbles left behind by the preceding crop. Supply of nitrogen can be effected by growing a leguminous green manure crop and turning it in in places where water is available. Otherwise nitrogen can be supplied through a nitrogenous fertiliser.

**Conclusion:** The study indicates that appreciable amounts of organic residues are left behind by a crop after harvest. Such residues are important from the point of building up soil humus for improving the fertility level of soils. In most places where there is no facility for raising green manures or where cattle manure supply is inadequate, the importance of crop residues cannot be over-estimated. But, for conversion of a larger portion of the organic residues into humus the nitrogen supply has to be augmented

and this can be effected by the addition of nitrogenous fertilisers such as ammonium sulphate, to facilitate decomposition of crop residues and their conversion into humus.

## REFERENCES

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TABLE I

*The yield of paddy grain and straw obtained from an acre as well as the estimated quantity of stubbles and roots:*

	In pounds					Average
	1	2	3	4	5	
Grain ..	4080	4260	3980	3780	4300	4080
Straw ...	6860	6960	6160	7340	7098	6884
Stubbles & Roots ..	2290	2470	2687	2178	2704	2466

TABLE II

*Proportion of crop residue to other parts, as percentage:*

	1	2	3	4	5	Average
Stubbles and roots to straw ..	33.38	35.49	43.61	29.67	38.10	35.81
Stubbles and roots to total aerial portion } ...	20.93	22.01	26.49	19.58	23.72	24.55
Stubbles and roots to the whole plant } ..	17.31	18.04	20.95	16.38	19.18	18.37

TABLE III

*Composition of stubbles and roots:*

	Proportion %	Nitrogen %	Phosphoric acid %	Potash %
Stubbles ..	41.2	0.403	0.172	0.777
Roots ..	58.8	0.373	0.199	0.991

TABLE IV

*The chemical composition of grain, straw, roots and stubbles (Percent on dry basis):*

Plant nutrients	1	2	3	4	5	Average
<i>Grain:</i>						
Nitrogen ..	1.120	1.120	1.330	1.310	1.070	1.109
Phosphoric acid ..	0.736	0.724	0.747	0.793	0.718	0.744
Potash ..	0.720	0.770	0.680	0.680	0.710	0.712
<i>Straw:</i>						
Nitrogen ..	0.630	0.639	0.600	0.511	0.525	0.581
Phosphoric acid ..	0.212	0.178	0.205	0.163	0.163	0.163
Potash ..	1.170	1.210	1.220	1.250	0.160	1.202
<i>Stubbles and roots:</i>						
Nitrogen ..	0.400	0.390	0.440	0.380	0.390	0.394
Phosphoric acid ..	0.290	0.290	0.250	0.250	0.230	0.262
Potash ..	0.960	0.990	0.980	0.960	0.970	0.972

TABLE V

*Plant food elements removed by the crop through grain and straw:*

Element	1	2	3	4	5	Average
<i>Grain:</i>						
Nitrogen ..	45.70	47.71	52.94	49.52	46.01	48.38
Phosphoric acid ..	30.04	30.84	29.73	29.98	30.87	30.29
Potash ..	29.38	32.80	27.07	25.71	30.54	29.10
<i>Straw:</i>						
Nitrogen ..	43.21	44.47	36.97	37.51	37.27	39.89
Phosphoric acid ..	14.54	12.05	10.63	11.96	11.57	12.55
Potash ..	80.26	84.21	75.17	91.75	82.34	82.75

TABLE VI

*Quantity of plant material left as crop residue and their manurial value in pounds per acre:*

	1	2	3	4	5	Average
Stubbles and roots ..	1700	1799	2223	1788	1955	1893
Organic carbon ..	427.40	534.40	632.50	543.70	534.00	534.40
Nitrogen ..	9.20	9.60	11.80	8.30	9.70	9.72
Phosphoric acid ..	6.60	7.20	6.70	5.50	6.20	6.44
Potash ..	16.32	17.82	21.79	17.17	18.06	18.41

TABLE VII

*Plant food elements removed by grain and straw and left as crop residue. Average Values:*

Nutrient elements	Grain and Straw	Stubbles and roots	Percentage on grain and straw
Nitrogen ..	88.27	9.72	11.01
Phosphoric acid ( $P_2O_5$ ) ..	42.84	6.44	15.03
Potash ..	111.85	18.41	16.45