1969

Fertility Build-Up in Wheatbelt Soils

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1969 RESULTS OF FIELD EXPERIMENTS

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FERTILITY BUILD-UP IN WHEATBELT SOILS

PROGRESS REPORT

Areas of loamy sand from Wongan Hills Research Station, which had carried subterranean clover for varying numbers of years, were sampled at five depth intervals to 60 cm. Wheat yield and a range of soil properties were related to numbers of years under subterranean clover.

Strong positive relationships were obtained between years under clover and grain yield, total nitrogen, organic carbon, total phosphorus, bicarbonate extractable phosphorus and acetic acid soluble phosphorus. Weaker positive relationships were obtained with organic phosphorus, total sulphur, cation exchange capacity and exchangeable bases. The relationship with pH was inconsistent and varied with soil depth.

The increase in soil nitrogen occurred mainly in the top 5 cm and there was no increase below 15 cm. In contrast to the supporting work on "mini ley" rotations, the nitrogen build-up in this soil has been almost linear with time up to 7 years. The difference is probably due to the rate of clover establishment and management under the different systems.

(To obtain some information on legume density and soil nitrogen build-up, a number of subterranean clover cultivars and other legumes were sown at a range of plant densities at various sites in the wheatbelt in 1969. The increase in soil nitrogen will be related to plant growth and plant density. Soil analyses from these sites are not yet available.)

The increase in organic carbon under pasture was largely confined to the top 5 cm and there was no significant increase below 10 cm. Most of the phosphorus added as superphosphate could be accounted for in the top 10 cm with some penetration to 30 cm in the oldest developed plots. Unlike phosphorus, there was little accumulation of sulphur with time and some sulphur enrichment could be detected at the lowest sampling depth indicating the low sulphur adsorbing capacity of this soil.

There was an increase in cation exchange capacity with time and an increase in exchangeable calcium magnesium and potassium in the surface horizon. An increase in exchangeable calcium could be expected from calcium applied in superphosphate. However, there had been no direct addition of magnesium or potassium to these soils. The enrichment of these elements in the top 5 cm has probably resulted from plant cycling from lower horizons. In the associated pot trial there was a bigger growth response to potassium on the virgin soil than on the soil which had been under pasture for 7 years.

Table 1.

Fertility Investigation - W.H.R.S. (W56H)

Relative Value (% of maximum)

Soil property(0-5 cm)	years under sub clover					
	0	1	2	4	6	7
Total N	33	62	65	85	81	100
Total P	27	60	73	73	92	100
Colwell P	1	54	66	75	84	100
Organic C	55	75	77	88	92	100
Total S	59	68	90	100	89	93
Yield/pot	7	48	50	75	88	100

The second stage of this project commenced in 1969 - the examination of changes in soil properties and constituents as the fertility accumulated during the pasture phase is exploited by a following wheat crop. The main experiment at Merredin Research Station was designed to follow changes in the mineralisation of soil nitrogen and crop response following different cultivation treatments. Unfortunately the drought conditions of 1969 caused an atypical sequence of wetting and drying cycles, there was little plant growth and no grain was set. The limited information from this experiment will be used to improve the experimental design for 1970.

At Esperance Research Station an experiment was carried out to determine the effect of the excessive dry cultivation associated with the clover seed harvesting operation on the following wheat crop. Apart from the organic matter removed with the clover seed, clover harvesting caused substantial losses of soil nitrogen and organic carbon resulting largely from the gross removal of surface soil by subsequent wind erosion. Vegetative yield, nitrogen uptake and final grain yield were all reduced by clover harvesting prior to cropping. These results provide a reference point for the expected losses in soil fertility resulting from severe and widespread wind erosion following the 1969 drought year in the wheatbelt of Western Australia.

Table 2.

Clover Harvesting - E.D.R.S. (69E10)

Relative Value (% of maximum)

	Number of harvesting operations		
	0	1	3
Soil N	100	60	54
Organic Carbon	100	74	68
Veg.Yield (Sept)	100	78	67
% N (Sept)	100	80	78
N. uptake (Sept)	100	63	52
Grain yield	100	89	81

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