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Fallow re-assessment - Wheat variety investigations- root growth and moisture use

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DEPARTMENT OF AGRICULTURE
WESTERN AUSTRALIA.

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February 1975

This report summarises progress and
data available for the following investigations -

1. Fallow Re-assessment
2. Wheat Variety Investigations - Root
Growth and Moisture Use.

1. Fallow Re-assessment - 72M29.

Aim: To re-examine case for fallow as an agronomic practice in Western Australia.

Location: Merredin Research Station.

Soil Type: Merredin clay loam.

History: Old pasture land - 7 years of barrel medic prior to 1972.

The programme which was initiated in 1972 included an establishment and assessment year for three adjacent sites which were to be used in successive years. The following treatments have been/are to be imposed during the establishment years.

1. Maximum moisture conservation treatment. To be cultivated with first rains and subsequently when necessary for weed control. Long Fallow.
2. Minimum moisture conservation. To be sown to wheat.
3. Chemical fallow. To be sprayed prior to seed set.
4. Mechanical fallow. To be cultivated after seeding operations. Standard fallow operation for the area.
5. Pasture - To be left in pasture.
6. Short fallow - To be left in pasture and cultivated if and when summer rains eventuate.

The timing of all operations to be left in the hands of the Farm Manager. The areas established in 1972 and 1973 were cropped for assessment in 1973 and 1974 respectively. Data that are being accumulated will describe effect of treatments on soil nitrogen, moisture conservation and yield. These data are to be supplemented by root distribution data as a function of moisture availability and pasture and grain protein analyses.

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Comments

Total available moisture at seeding and grain yields for 1973 and 1974 are listed in Table 1.

A. 1973 Results

1. Maximum moisture storage of 7.97 cm with the long fallow treatment contrasted significantly with the 2.59 cm following cropping in 1972. Yields were accordingly significantly higher with long fallow.
2. The differences between the 'standard' fallow treatments were minimal with a slight advantage to mechanical fallow.
3. The higher yield from long fallow and the difference between long fallow and continuous cropping resulted despite excellent growing conditions in 1973.

B. 1974 Results

1. Pre-season rainfall in 1974 overwhelmed differences in stored soil moisture which developed by December 1973.
2. Apart from stored moisture being highest with long fallow there was no consistent trend in the amounts of moisture stored under the other treatments.
3. Yields were similarly variable with lowest yields following the long fallow treatment. Long fallow plots were very sticky at and after seeding. Some sealing action may have followed to reduce germination in these plots.
4. Stored moisture at planting was significantly higher in 1974 than 1973.
5. One third of the area under investigation was washed out by the heavy rain experienced in 1974.

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2. Wheat Variety Investigations - Root Growth and Moisture Use.

Location: Wongan Hills Research Station.
Merredin Research Station.

Early root growth and subsequent root penetration to depth were examined in 9 varieties of wheat supplied by Dr. N.N. Roy of the Wheat and Sheep Division. Selection over several years led to the establishment of variety groups of high and low growth vigour which included high and low yielding varieties within each. Current investigations were concerned with two varieties from each group and Gamanya. The aim of these investigations was to examine growth parameters with a view to establishing a relationship with yield, if any existed.

Data to hand (Table 2) show a relationship between mean number of seminal primary axes per plant and yield within each vigour group. High yields in both groups were associated with low numbers of seminal primary axes. A similar relationship is seen to develop by 4 weeks after planting with seminal 1st order branches (Table 2). Examination of nodal root axes at plant maturity showed no indication of a relationship with yield. This latter observation was unexpected in that it contrasts with observations made by other workers. The seminal root data are interesting in that the differences have proved consistent with time of sampling and show some relationship with yield within vigour groups. These data contrast with the observations of 1972 and 1973 where consistency of result was clearly absent in a range of current and ex-commercial varieties.

Depth of rooting data at 6 weeks after planting were suggestive of earlier penetration to depth with low than high vigour groups and with high yielders than low yielders within each vigour group. Confirmation of these observations did not follow at later times of sampling. Differences were also not immediately apparent between varieties in the moisture profile data accumulated at each site of investigation.

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Table 1. Available water at seeding, growing season rainfall and yields in 1973 and 1974.

	1973 Data		1974 Data	
	Available Soil Moisture at seeding(cm)	Yield (kg/ha)	Available Soil Moisture at seeding (cm)	Yield (kg/ha)
Continuous Crop	2.59	1055.6	12.99	3444.4
Short Fallow	4.49	1381.9	12.67	3166.7
Pasture - Crop	4.67	1546.4	13.16	3866.7
Chemical Fallow	5.18	1444.4	13.61	3511.1
Mechanical Fallow	6.01	1569.4	13.86	3433.3
Long Fallow	7.97	1791.6	14.65	3166.7
Rainfall Seeding to October	274 mm		307 mm	

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Table 2. Numbers of Primary Seminal Axes and First Order Branches (Secondary Roots)
Per Plant - Means of 18 or more plants.

Vigour - Yield Rating Variety	Plot Yields 1973 (kg)	Seminal Primary Axes			Seminal First Order Branches		
		Plant age, Days after planting			Plant age, Days after planting		
		14	21	27	14	21	27
High Vigour - High Yield							
M.70 - T196	7.83	3.6	4.3	4.4	17.1	109.2	143.7
M.70 - Q157-290	8.12	4.7	4.8	4.6	13.2	112.6	168.5
High Vigour - Low Yield							
NP 860	5.32	5.0	5.4	5.1	15.5	138.5	198.2
Pacific	3.35	4.8	5.5	5.6	9.8	131.9	215.1
Low Vigour - High Yield							
64 - W12 - 18	7.13	3.8	4.4	4.9	15.7	119.1	143.6
64 - W12 - 19	6.93	4.3	4.7	4.9	11.5	118.4	167.2
Low Vigour - Low Yield							
M70 - N156 - 1	6.37	4.8	5.2	5.0	9.1	115.2	190.3
M70 - 580 - 39	6.38	5.2	5.5	5.2	10.4	122.1	210.3
Gamenya (High Vigour-High Yield)	8.10	4.6	5.0	4.7	15.6	117.3	182.6