Challenges facing the Family Farm - proceedings of a seminar

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CHALLENGES FACING THE FAMILY FARM

- proceedings of a seminar

CUNDERDIN
July 28 - August 1, 1980

Western Australian Department of Agriculture
### CHALLENGES FACING THE FAMILY FARM

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Challenges Facing The Family Farm

The papers put forward should be valuable reference to all farmers in the wheatbelt. My aim in organising this seminar was an attempt to bridge the gap between experts and farmers.

After nine years in the Department I've met numerous people with realistic and helpful messages for farmers to act upon. Most of these people are included as contributors to this booklet.

My sincere thanks go out to all contributors and participants in particular The Farm Management Foundation and Nola Maitland who both gave me many speakers to invite. I thank Mrs. K. Davis and Miss R. Thomas for their help.

Tom Sweeny
Department of Agriculture
Northam

Nov. 1980
LAND FOR LEASE!  
Peter Hackett

Why on earth would you want to lease farm land!

Maybe because -
1. You've got too much plant
2. Young Tim's come home from Agricultural College
3. You need the sheep feed
4. You want to try before you buy
5. You might get first bite at the purchase
6. You can't afford to buy
7. No land around to buy
8. Profit is your motive

How would you describe your objectives. Try the following scale.
The good life, enough cash to live happily, plenty of leisure time 10 points
Good life, leisure and a bit of capital growth 7 points
Equal doses of both 5 points
Mainly capital growth with a bit of the good life 3 points
In the equity race - maximum growth of capital 1 point

Score 1 - 5 You're probably wasting your time leasing land
Score 7 - 10 Leasing may have a role in specific circumstances but not in most.

Most farmers make money by owning land and they only farm it to generate some liquidity. The comprehensive 1980 Agribusiness Budget Guide suggests that the following average profit can be achieved by farming land.

<table>
<thead>
<tr>
<th>Crop</th>
<th>Gross Margin</th>
<th>Average Gross Margin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat 1.2t/ha</td>
<td>$66/hectare</td>
<td>$43/hectare</td>
</tr>
<tr>
<td>Sheep 2.5/ha</td>
<td>20/hectare</td>
<td></td>
</tr>
</tbody>
</table>

If land were leased for say $23/ha there is a profit margin of $20/ha from farming the leased land (The profit will be a bit higher if machinery ownership costs are unchanged.)
This profit represents $14/ha after tax or 3% on capital.

Land values have over the past few years increased at more like $70/ha or 15% on capital.

Wouldn't you be better off buying the land then farming it rather than leasing it.

i.e. Capital gain $70/hectare
   Farming profit 14/hectare after tax
   -
   84/hectare

Less interest on loan 13% $60/ha 42/hectare after tax
   -
   Profit after tax $42/hectare

or better still buy it and lease it out.

So you're over capitalised in plant. Then you can sell some plant, buy some more land rather than lease it, or simply do the job quicker and get a longer life out of the plant.

If Tim comes home you can spend more time looking for other investments.

If you need sheep feed then you might consider agistment, selling sheep seeing the prices are reasonable, or buying land for the sheep

If you lease because you want to try before you buy you'll never buy because prices get away from you. Maybe if you are concerned that you can't find the right place it will be better to buy with a view to reselling later when the right opportunity arises.

Options to buy at market value aren't really worth much. Leasing to get first bite at the cherry when the owner decides to sell is a very vague reason for leasing.

Who said you can't afford to buy. An investment for those that score between 1 - 5 doesn't have to be next door. It may be at Badgingarra, Lake Varley, Esperance or Geraldton. If you agree with the idea that land ownership makes money than maybe its better if your purchase is not next door because then you may be forced to leave it to someone else rather than farming it yourself.

There are funds available for land purchase. Sure the ease with which a loan can be raised varies but nothing ventured nothing gained.

What about your ability to repay the loans and finance working capital?
The system is geared so that farmers don't go broke provided they own land. There are many avenues open to repay loans. They don't only include farming the land for a return that doesn't meet the interest bill let alone the total repayments, other landholdings may provide the servicing ability. Refinancing debts with other loans, less plant replacements, employing sharefarmers, machinery leaseback, selling land for cash and purchasing more land on terms etc. all provide avenues for debt servicing. Its usually only the first two years or so that can be tight. Inflation helps servicing.

The number of farmers is declining. If you rate 10 on the scale you may still need to purchase more land just to maintain yourself in farming. If you rate 1 - 5 you're worth $10/hour driving the tractor but $50 - $100 per hour searching for other investments to achieve the objectives you've set yourself.
PRESENTING A CASE FOR FINANCE  T. Martella

Your Bank Manager is interested in matching the bank services he can provide to your financial requirements. A planned approach to borrowing will optimise your chance of obtaining finance from the Bank. In assessing an application for finance, your Bank Manager will be most concerned with

1) Your Personal Equation - how he sees you as a borrower of depositors' money;

2) Your Repayment Ability; and

3) The Security which you can provide

PERSONAL EQUATION

It is important that you know your Bank Manager and build up a sound professional relationship with him. A positive track record would include:-

1) A regular borrowing and repayment history

2) Accounts in credit - Term Deposits and Savings Bank accounts with the bank reflect favourably on the Bank Manager

3) Periodic consultations with the Bank Manager on the status of the current account and overdraft limits.

This will ensure a satisfactory personal equation. A Bank Manager will be more inclined to quickly process your finance application if you are a responsible customer.

The timing of your application will bear on its success. It is worth your while to have an appreciation of

i) whether credit is generally easy or tight, and

ii) which financial institutions have finance available. This influences the rate of processing of your application.

The relationship which you can build with your Bank Manager prior to a finance application will serve to establish a professional basis on which satisfactory repayment ability and security can be arranged.

REPAYMENT ABILITY

1) Proposal

Clearly set out the details of the Proposal, including

a) Purchase price of land, plant and/or stock.

b) Funding of that part of the purchase price not covered by the loan. If vendor finance is involved, the amount term and interest rate of the loan.

c) The Bank Loan requested. Amount, interest rate and term.
Example:

- Purchase 500 ha. land fully developed: $100,000
- Purchase 1000 Merino 2 tooth Ewes: $16,000
- Purchase Used Chamberlain Tractor: $14,000

$130,000

PROPOSED FUNDING

<table>
<thead>
<tr>
<th>Description</th>
<th>$</th>
<th>$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vendor (10 years @ 10% pa)</td>
<td>50,000</td>
<td></td>
</tr>
<tr>
<td>Cash from Term Deposit</td>
<td>50,000</td>
<td>100,000</td>
</tr>
<tr>
<td>Bank Loan Requested (10 years @ 10% p.a.)</td>
<td>30,000</td>
<td></td>
</tr>
</tbody>
</table>

$130,000

2) Liabilities

A list of present and proposed liabilities should be prepared as follows.

a) Secured Debts - the lender, type of security (i.e. Mortgage, Bill of Sale), amount owing, interest rate and terms of repayment.

b) Unsecured Debts - the lender, amount owing, interest rate and terms of repayment.

3) Farm Programme and Production Statistics

In order to assess the viability of your proposal, the Bank Manager will require your production programmes and statistics over 5 years. This will include:-

(a) A schedule of crops grown, respective areas and production yields per hectare.

(b) A livestock programme indicating type, sex and age of livestock, lambing/calving date and percentage, purchases and sales is necessary information. Also the date of shearing and wool yield per head.

4) Proposed Farm Programme

Your farm programme will expand with the purchase of more land. An outline of the new programme will be needed. This will show:-
a) A similar schedule of proposed cropping and livestock programmes.

b) Any build up in livestock numbers to achieve the livestock programme.

c) Whether any additional machinery or labour will be required to achieve the cropping programme.

d) Development costs which may need to be undertaken, such as fencing, clearing, dam sinking and soil conservation.

e) The necessity to construct sheds, tanks, silos or other buildings, should be noted.

This information is a plan of the future farm programme which will become a static situation in 3 or 4 years time after these additional items are acquired. Generally, the intended programme is an extension of the applicants existing production performance over the larger area in a year-in-year-out situation.

5) **Year-In-Year-Out Estimate of Viability**

Information from sources such as the Department of Agriculture, Banks, and Farm Management Consultants, together with your past years' results will be used to estimate prices paid and prices received on the farm.

a) **Year-In-Year-Out Income**

Prices for agricultural produce are evaluated according to a long term upward trend rather than a short term trend (year to year) which would show high price variability.

Example: **ASSESSMENT STANDARDS, AUGUST 1979**

<table>
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<tr>
<th></th>
<th>Annual</th>
<th>Y.I.Y.O.</th>
</tr>
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<tr>
<td>Fat Lambs</td>
<td>$14/head</td>
<td>$12/head</td>
</tr>
<tr>
<td>Baby Beef</td>
<td>$200/head</td>
<td>$120/head</td>
</tr>
<tr>
<td>Wheat (total price)</td>
<td>$110/tonne</td>
<td>$95/tonne</td>
</tr>
<tr>
<td>Barley (total price)</td>
<td>$85/tonne</td>
<td>$80/tonne</td>
</tr>
</tbody>
</table>

b) **Year-In-Year-Out Expenditure**

The costs associated with the farm programme can be determined by reference to past costs per hectare and multiplied by an inflation factor.

Estimated expenditure will comprise:

1) Farm Operating Costs - present day multiplied by a factor of 10%

2) Living, Education and Personal.

3) Interest on Working Capital - calculated at bank overdraft rates on the total of all operating expenses plus half living costs.
4) Taxation Estimate based on last 3 year's returns.
5) Plant replacement based on 12.0% of new value.
6) Debt repayment - interest charges and principal repayments on existing and proposed debts.

c) Viability

As a rule of thumb, a surplus of income over expenditure (Y.I.Y.O.) equivalent to at least 10% of estimated gross farm income would suggest that the proposal is reasonably viable. This surplus caters for fluctuations in income and expenditure which could otherwise render the proposal non-viable.

Where the surplus indicates that the proposal is only marginally viable you should investigate alternative cropping or livestock programmes or possible other variations to the proposal which will provide a greater surplus.

The size of the surplus determines the ability to repay the loan. For instance, if the surplus is $6,000 and the annual repayment on a $30,000, 10 year loan @ 10% is $4,883 p.a., then those repayments can be readily met. The surplus may not meet repayments on a loan over shorter term with higher interest rates.

j) Cash Flow - Can You Get There?

Once the Y.I.Y.O. ability of your proposal is established a cash flow will be necessary in order to determine the carry-on finance requirements in the early stages of the expanded programme.

The Manager will need:-

(a) A monthly cash flow for 12, 24 or 36 months so he can determine the peak debt and the year in which it will occur.

(b) To refer to last years budgeted and actual cash flows and the previous 3 years tax returns to determine tax liability.

SECURITY

Your Bank Manager must establish that there is sufficient security for the loan. You can assist him by providing the following information.

1) Estimated Value of Land

This can be determined if you provide:-

a) A map of both your existing farm and the farm you propose to purchase. These will indicate:-
- Total area
- Cleared area - arable and non-arable
- Bush - arable and non-arable
- Fences - type and condition
- Pastures - grasses and covers
- Water Points - dams, bores, tanks and C.W.S.

b) A description of buildings, ages, conditions and adequacy.

c) A list of comparative sales in the area indicating price, area and buildings.

2) Value of Existing and Proposed Stock and Plant

a) Plant and machinery - current market value.

b) Stock - number, age and sex and market value of stock on hand.

3) Statement of Position

Show your equity before and after the proposed purchase. An equity of 60% or more would indicate good security for the loan.

SUMMARY

Your managerial ability needs to be top class in negotiating finance for a property purchase. Your Bank Manager will need to establish your ability to repay the loan required, and that sufficient security is available to cover that loan. This cannot be successfully established unless your Personal Equation with your Bank Manager enables you to discuss the proposal on a professional basis and resolve a solution satisfactory to both yourself and the Bank Manager.
In presenting some thoughts to you about the opportunities for investment in the Securities Market (as distinct from the Share Market), I include such investments as ordinary shares, debentures, Commonwealth Government Securities, Semi-Government Securities, - I suggest that consideration should be given to the following aspects:

(1) The objectives of the investment plan - is there a requirement to diversify investment funds? Are funds to be invested on a short or longer term basis?

(2) The degree of risk to be undertaken - this is always an important consideration with any form of investment.

(3) Marketability - how readily saleable or marketable is the investment in the event of a quick sale being required?

(4) Is longer-term capital growth more important than shorter-term income return?

(5) Is a fixed rate of return required for a specific period of time and for a specific reason? e.g. investment of tax funds where a specific requirement date is known, or perhaps income from an investment may be required to supplement income from other sources.

(6) To what extent are tax aspects important?

Superimposed on these considerations is the question of - what will be the rate of inflation during the period for which I wish to invest my funds? The answer to this question is very important since it will set the parameters for an investment programme or plan which should be designed to provide a specific rate of return on funds invested.

In planning an investment programme, consideration must be given to:

(a) An awareness of the rate of change.

(b) The need to set different objectives.

(c) The need to do something about it oneself - in other words, investment is not a static process, and the investor who is prepared to adjust his plans to accommodate the changing world around him will be better placed to maximise the return from his portfolio.

In more recent times, investors, in making a judgment of future expectations, have been required to assess and analyse such matters as:

(a) Political developments and policies - in this context, investment decisions and expectations have been directly affected in more recent times by such factors as:
(i) Change of Federal Government

(ii) Implementation of fiscal and monetary policies and the extent of their severity - i.e. credit squeeze, taxation structure.

(iii) Prices Justification Tribunal

(iv) The re-allocation of resources between the private and public sector and the pressures which have been created in the economy as a consequence.

(b) The rate of inflation - you will all no doubt be aware of the problems which are being experienced in this area. Inflation gives few of us a "fair go" - something for which Australians are noted and proud of.

(c) The rate of interest - interest rates are currently at high levels, and as you will no doubt realise this is a direct result of the high level of inflation which exists. Changing interest rates mean changing returns on other comparable investments, which can have a direct bearing on the particular form of investment which may be recommended as being suitable.

(d) Prospects for the different sectors of the economy, and in particular how they may change following implementation of Government policies.

The first section to look at when considering investment is ordinary shares. Generally speaking, the price of ordinary shares moves in accordance with changing economic conditions, company profits, asset values and investment expectations. The ordinary share markets are generally categorised into the industrial market, the mining market, and the oil market. You will no doubt appreciate that there are different aspects affecting investment decisions in each section of the market as outlined above, and this, to a large degree, depends on the extent of the risk and rate of return which an investor may be seeking. It is generally recognised that the mining and oil sections of the market are more volatile in terms of price fluctuation than is the industrial sector, and this depends to a large extent on the wide fluctuation in commodity prices. You will no doubt be aware of the recent fluctuations in the prices of such metals as copper, oil, gold and so on, and the effect which these price movements have had on the shares of the respective companies.

When considering investment in ordinary shares, due consideration must also be given to the various rates of return which can be expected. Depending on the particular industries in which they operate, some companies at present are better placed than others to increase their dividend distribution to shareholders, and the investment adviser will take this into account when making his recommendations. On the other hand, some investors may choose to invest in shares providing a low immediate return, or in fact no return at all, in the hope that as developments take place in the years ahead for the particular company in which they have invested, they will be more than compensated by an increase in the capital value of their investment.
There is also the opportunity to invest in fixed interest securities, and these take the form of Government securities, debentures, unsecured notes, convertible notes, preference shares. In this category investment funds are generally placed for a specific period of time, or an agreed rate of interest. As the name implies, convertible notes may be interchanged into ordinary shares at some future date under conditions as set out by a particular company. Investment in preference shares is generally made on the basis of a fixed income return, although opportunities for capital gain do occur from time to time.

Debentures have become a more popular form of investment in recent months following the high rates of return which have been available, and companies have been forced to increase their rates to competitive levels. You may be aware that finance companies are continuing borrowers of funds in the debenture market, and most have prospectuses "on tap" as they are constantly endeavouring to attract funds in order to expand their operations and increase profitability. On the other hand, industrial companies do not make debenture issues as frequently as finance companies, but they generally have a higher net asset cover and debenture interest cover, and as such they are probably a more gilt edged investment when compared with finance company debentures. Industrial companies too have been forced to increase their rates as funds have remained scarce in the Australian economy under the influence of the Federal Government's liquidity squeeze.

You may have noticed that when the Commonwealth Government decides to influence the level of liquidity in the economy by movement in the interest rate structure, this will be directly reflected in movements in the yields available on Commonwealth Government securities, be they in the form of a new loan, or variations in the yields available on existing securities. Following a decision to vary the level of official interest rates, returns from investments in other sections of the investment market will then be adjusted accordingly, and this is reflected in the changing capital values of investments.

I have also found from experience that companies are prepared to quote competitively for funds of a short-term nature at the present time, and in spreading their investment portfolio, investors have had the opportunity to build into their investment programme these high rates of return.

Having looked at the experience of the recent past, and having also given consideration to other important developments, let us now have a look at the future.

When considering an investment portfolio, due regard should be given to an adequate spread of investment risk, and it is important, as mentioned earlier, that the person with the funds to invest has a relatively clear picture and objective of the goals which he is seeking. A high rate of return may be required, or alternatively a moderate return with a stronger prospect of capital appreciation, or the investor may want a high asset cover for his investment, and be prepared to invest in more steady areas rather than to take a higher degree of risk.
Recently I was analysing the opportunities for investment in the resources sector of the market and the following is a summary of the conclusions which I drew:

The year 1979 saw 3 young resource rich countries outperform the more older and industrialised countries, South Africa, Canada and Australia - this trend is very likely to continue for some considerable time.

**Australia's Role As A Supplier of Energy**

Results of OPEC - instability -

(1) Supply/demand of oil

(2) Pricing structure - implications for Australia oil pricing - benefits to BHP and its shareholders - heading to self-sufficiency:

- Petroleum - oil/gas - Bass Strait, N.W. Shelf, Exmouth Plateau
- Uranium - problems gradually being overcome
- Coal - steaming - major exporter - stable and reliable
- Shale - early days - very much interior

**Recent Newspaper Articles**

Coal - Japan - reliable and stable supply requirements
Shale - Development in Queensland

Plenty of cash for direct investment in the projects - coal, uranium, shale, NW Shelf project.

BUT WHY do some sections of the press knock the market growth aspect of investment in this sector?

**Australian Government**

Now supporting petroleum exploration - rebate of funds subscribed - could be higher. Also benefits introduced in last Budget of conversion from oil to other fuel usage.

Australia is rich in energy based minerals - in a troubled world thirsty for energy. Recall briefly the extent of Australia's energy reserves -

(a) free world's second largest exporter of coal

(b) possess nearly ¼ of free world's uranium reserves and ¼ of the Western World's most economic reserves.

(c) massive reserves of natural gas - NW Shelf 7% of Western World's natural gas reserves.
As oil becomes an increasingly scarce and costly commodity and given the unpredictable and unstable position in the Middle East, it is clear that Australia's reserves of coal, gas and uranium become of increasing importance in the world energy scene and to astute investors.

Multiplier benefits of developing Australia's energy deposits - many other companies will benefit and so will their shareholders, as well as astute investors.

**Stocks of Interest**

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<th>Company</th>
<th>Description</th>
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<tr>
<td>Woodside</td>
<td>70¢ to 3.40 - transformation of NW Shelf economics - price of gas - oil prices - likely to become second largest cash flow company in Australia in 1980's after BHP as long as the environmentalists don't win!</td>
</tr>
<tr>
<td>C.S.R.</td>
<td>3.00 - 7.40 - clearly defined management policy to more strongly emphasise energy. - takeover Queensland coal deposit AAR - Western Collieries - locally</td>
</tr>
<tr>
<td>W.M.C.</td>
<td>2.50 - 5.50 - uranium, coal</td>
</tr>
<tr>
<td>Griffin Coal</td>
<td>4.40 - 16.50 - SEC demand and projected growth</td>
</tr>
<tr>
<td>Pancontinental</td>
<td>4.00 - 9.50 - largest uranium deposit in the world - gradually overcoming the problems - I'd venture to say probably one of the best risk/reward investments seen in Australia for some time.</td>
</tr>
<tr>
<td>White Industries</td>
<td>5.00 - 31.00 - recently strong trading - control for coal deposit - valuable to some people.</td>
</tr>
<tr>
<td>Central Pacific</td>
<td>5.00 - 70.00 - oil shale deposits in Queensland - still away from development but plenty of interest. Not so long ago - plenty of knockers - now investment and government support.</td>
</tr>
<tr>
<td>Industries</td>
<td></td>
</tr>
<tr>
<td>Bond</td>
<td>50¢ - 2.25 - penetration into energy areas Santos - Cooper</td>
</tr>
<tr>
<td>Howard Smith</td>
<td>Coal</td>
</tr>
<tr>
<td>M.I.M.</td>
<td>Coal - oil exploration</td>
</tr>
<tr>
<td>Consol Press</td>
<td>Publication Co. - now strongly coal.</td>
</tr>
<tr>
<td>H.C. Sleigh</td>
<td>Coal</td>
</tr>
</tbody>
</table>
Substantial EXPLORATION PROGRAMMES underway for coal, oil/gas, uranium - Australia's record of exploration success over many years. E.G.

Central Australian area -
Amadeus Basin - oil & gas -
Aboriginal land rights overcome -

More action and discoveries likely in this highly prospective area.

Concluding Remarks

Australia continues as a major area for investment - resources and energy base - market prices, fluctuate particularly short term influences. However, I strongly believe that Australia will continue to offer both local and overseas investors attractive opportunities for investment and particularly in the energy sector.

Looking at the future, overseas interest in the resources, energy and exploration sectors seems likely to continue at strong levels and will have a continuing important influence on market trading and price volatility. Indeed the massive resource developments planned for Australia in the 1980's have attracted unprecedented overseas interest in the share market. However, Australia's reputation as a high protection high wage and low productivity nation is resulting in little overseas interest in the retailing or manufacturing sector (other than in resource related companies). Australian institutions will also again be cashed up with September quarter funds allocations and looking for attractive opportunities. As always private clients play an important role in the stock market and we see no evidence of declining participation on their part.

We would point out that the Australian mining and oil industries are on the verge of their biggest expansion since the development boom of the 1960's following significant changes in the world energy market. Domestic energy prices have provided the mining and refining industry with new-found competitive edge against overseas producers while the extent of Australia's energy resources has allowed a measure of long-term confidence. Importantly Australia's comparatively lower rate of inflation has allowed the mining industry to become more cost competitive. Against fears of a recession and reduced metal demand are balancing factors such as increasing energy prices. With Australia's coming development boom based on energy considerations, we believe it most unlikely that recessionary fears will have a marked effect on expansion plans.

The important contribution of exploration to Australia's economic prosperity is often overlooked by investors and market observers. Mineral exploration is, in real dollar terms, well above the peak expenditure of the 1970/71 boom. This upsurge now includes exploration for a broader range of minerals and a much greater commitment by established mining companies (besides the juniors) to exploration. Oil exploration is also running well above optimistic forecasts made by the industry at the beginning of this year.
Clients are recommended to maintain a fully invested position in the stock market with continuing emphasis on the important resources sector (particularly energy related stocks). Those industrial companies closely involved with the development of Australia's minerals and petroleum resources will also offer attractive investment opportunities.

In summary, such fundamentals as:

(a) vast energy reserves
(b) stable and responsible Government
(c) responsible economic management
(d) undervalued dollar
(e) high standards of living
(f) sound economic indicators

underwrite a strong base for investment in Australia.
<table>
<thead>
<tr>
<th>ALL POLICIES INCLUDE</th>
<th>A.M.P.</th>
<th>M. TRENORDEN</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>INVESTMENT</strong></td>
<td>$1,100</td>
<td>$1,600</td>
</tr>
<tr>
<td>MATURE AGE</td>
<td>65</td>
<td>65</td>
</tr>
<tr>
<td>Annual Premium:</td>
<td>$675</td>
<td>$983</td>
</tr>
<tr>
<td>Advance Premium</td>
<td>$425</td>
<td>$617</td>
</tr>
<tr>
<td>TOTAL CONTRIBUTION:</td>
<td>$1,100</td>
<td>$1,600</td>
</tr>
</tbody>
</table>

At the end of 10 years the Advance Premium Account has grown to:  

|  | $7,450 | $10,816 | $12,849 | $20,965 | $20,965 | $20,965 | $29,748 |

The 11th premium is paid, this leaves:  

|  | $6,775 | $9,833 | $11,682 | $19,061 | $19,061 | $19,061 | $19,061 | $27,045 |

Invested at 10.00% producing  

|  | $675 | $983 | $1,167 | $1,906 | $1,906 | $1,906 | $1,906 | $2,704 |

TAX FREE! To pay future premiums of:  

|  | $675 | $983 | $1,167 | $1,904 | $1,904 | $1,904 | $1,904 | $2,703 |

WHEN THE POLICY MATRUES HE RECEIVES:  

| Estimated Maturity Value: | $145,207 | $145,058 | $117,236 | $128,944 | $82,560 | $47,818 | $74,900 | $63,771 |
| Advanced Premium Account: | $6,775 | $9,833 | $11,682 | $19,061 | $19,061 | $19,061 | $19,061 | $27,045 |
| No Final Premium: | $677 | $983 | $1,168 | $1,906 | $1,906 | $1,906 | $1,906 | $2,704 |
| TOTAL CASH PAID OUT: | $152,659 | $155,874 | $130,086 | $149,911 | $103,527 | $68,685 | $95,867 | $93,520 |
| Less Paid for 10 Years: | $11,000 | $16,000 | $19,000 | $31,000 | $31,000 | $31,000 | $31,000 | $33,000 |
| TAX FREE PROFIT: | $141,659 | $139,874 | $111,086 | $118,911 | $72,527 | $37,785 | $64,867 | $49,520 |

DEATH COVER commences at:  

| (Policy & Advance Premium Refund) | $28,433 | $34,987 | $34,855 | $46,101 | $36,260 | $26,995 | $33,467 | $35,611 |
| | $28,008+ | $34,370+ | $34,122 | $44,905+ | $35,365+ | $25,799+ | $32,271+ | $33,914 |

INCREASING TO - BY MATURITY:  

| Plus additional Terminal Bonus | $152,659 | $155,874 | $130,086 | $149,911 | $103,527 | $68,785 | $95,867 | $93,520 |
| | $166,889 | $170,089 | $141,575 | $162,547 | $110,049 | $71,654 | $101,784 | $97,346 |
### Advance Premium Account Interest Used To Maintain Premiums (10%)

<table>
<thead>
<tr>
<th>Total Number of Contributions</th>
<th>Percentage of contribution available to pay premium. (Remainder must be applied to advance premium account)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>37.91%</td>
</tr>
<tr>
<td>6</td>
<td>43.55%</td>
</tr>
<tr>
<td>7</td>
<td>48.68%</td>
</tr>
<tr>
<td>8</td>
<td>53.35%</td>
</tr>
<tr>
<td>9</td>
<td>57.59%</td>
</tr>
<tr>
<td>10</td>
<td>61.44%</td>
</tr>
<tr>
<td>11</td>
<td>64.95%</td>
</tr>
<tr>
<td>12</td>
<td>68.14%</td>
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<tr>
<td>13</td>
<td>71.03%</td>
</tr>
<tr>
<td>14</td>
<td>73.67%</td>
</tr>
<tr>
<td>15</td>
<td>76.06%</td>
</tr>
</tbody>
</table>

**Example**

A man wishing to make only 8 contributions of $1,900 can have a policy where the annual premium is:

\[
53.35\% \text{ of } $1,900 = $1,013.65
\]

i.e.  
- **Annual Premium:** $1,013.65  
- **Advance Premium:** $886.35  
- **Total Contribution:** $1,900.00
ILLUSTRATION OF THE EFFECT ON NET POLICY COSTS OF REINVESTING AVAILABLE LOAN VALUES IN A BUSINESS:

POLICY ON A MALE LIFE AGE 30 NEXT BIRTHDAY

SUM INSURED $100,000. TABLE ALA PREMIUM $1,750. PAYABLE YEARLY:

<table>
<thead>
<tr>
<th>DURATION FROM COMMENCEMENT IN YEARS</th>
<th>NET DEATH COVER (SUM INSURED PLUS BONUSES LESS '6')</th>
<th>O U T G O I N G S</th>
<th>TOTAL AMOUNT BORROWED (SEE NOTE 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>'1' '2'</td>
<td>$</td>
<td>'3' '4' '5' '6'</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>100,000</td>
<td>1,750 0 1,750</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>102,067</td>
<td>1,750 0 1,750 883</td>
<td>2,992</td>
</tr>
<tr>
<td>2</td>
<td>102,988</td>
<td>1,750 52 1,802 2,992</td>
<td>4,625</td>
</tr>
<tr>
<td>3</td>
<td>104,485</td>
<td>1,750 178 1,928 4,625</td>
<td>6,369</td>
</tr>
<tr>
<td>4</td>
<td>105,961</td>
<td>1,750 275 2,025 6,369</td>
<td>8,202</td>
</tr>
<tr>
<td>5</td>
<td>107,438</td>
<td>1,750 378 2,128 8,202</td>
<td>10,155</td>
</tr>
<tr>
<td>6</td>
<td>108,895</td>
<td>1,750 487 2,237 10,155</td>
<td>12,218</td>
</tr>
<tr>
<td>7</td>
<td>110,352</td>
<td>1,750 603 2,353 12,218</td>
<td>14,390</td>
</tr>
<tr>
<td>8</td>
<td>111,790</td>
<td>1,750 726 2,476 14,390</td>
<td>16,703</td>
</tr>
<tr>
<td>9</td>
<td>113,197</td>
<td>1,750 855 2,605 16,703</td>
<td>19,145</td>
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<tr>
<td>10</td>
<td>114,595</td>
<td>1,750 992 2,742 19,145</td>
<td>21,717</td>
</tr>
<tr>
<td>11</td>
<td>115,963</td>
<td>1,750 1,137 2,887 21,717</td>
<td>24,463</td>
</tr>
<tr>
<td>12</td>
<td>117,277</td>
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<td>27,359</td>
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<tr>
<td>13</td>
<td>118,561</td>
<td>1,750 1,453 3,203 27,359</td>
<td>30,413</td>
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<tr>
<td>14</td>
<td>119,817</td>
<td>1,750 1,625 3,375 30,413</td>
<td>33,672</td>
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<tr>
<td>15</td>
<td>120,988</td>
<td>1,750 1,807 3,557 33,672</td>
<td>37,052</td>
</tr>
<tr>
<td>16</td>
<td>122,168</td>
<td>1,750 2,000 3,750 37,052</td>
<td>40,661</td>
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<tr>
<td>17</td>
<td>123,259</td>
<td>1,750 2,201 3,951 40,661</td>
<td>44,448</td>
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<tr>
<td>18</td>
<td>124,312</td>
<td>1,750 2,415 4,165 44,448</td>
<td>48,491</td>
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<tr>
<td>19</td>
<td>125,249</td>
<td>1,750 2,640 4,390 48,491</td>
<td>52,657</td>
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<td>20</td>
<td>126,203</td>
<td>1,750 2,880 4,630 52,657</td>
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</tr>
<tr>
<td>RECEIPTS:</td>
<td>NET INTEREST EARNED ON LOAN: (SEE NOTE 4)</td>
<td>GROSS RECEIPTS FOR YEAR ('7'- '8')</td>
<td>NET OUTLAY FOR YEAR ('5'- '9')</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
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<td>---</td>
</tr>
<tr>
<td>FURTHER LOAN AVAILABLE. (SEE NOTE 2)</td>
<td>'7'</td>
<td>'8'</td>
<td>'9'</td>
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<tr>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
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<tr>
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<td>1,750</td>
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<tr>
<td>883</td>
<td>0</td>
<td>883</td>
<td>867</td>
</tr>
<tr>
<td>2,109</td>
<td>95</td>
<td>2,204</td>
<td>402 CR</td>
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<tr>
<td>1,633</td>
<td>323</td>
<td>1,956</td>
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<tr>
<td>1,744</td>
<td>499</td>
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<tr>
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<td>392 CR</td>
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<tr>
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<td>885</td>
<td>2,838</td>
<td>601 CR</td>
</tr>
<tr>
<td>2,063</td>
<td>1,096</td>
<td>3,159</td>
<td>806 CR</td>
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<tr>
<td>2,172</td>
<td>1,319</td>
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<td>1,015 CR</td>
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<td>2,313</td>
<td>1,554</td>
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<td>2,442</td>
<td>1,803</td>
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<td>1,503 CR</td>
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<td>2,572</td>
<td>2,067</td>
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<td>2,896</td>
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<td>2,954</td>
<td>6,008</td>
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<td>6,543</td>
<td>2,986 CR</td>
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<td>3,636</td>
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<td>4,001</td>
<td>7,610</td>
<td>3,659 CR</td>
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<td>4,013 CR</td>
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<td>4,800</td>
<td>8,843</td>
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<tr>
<td>4,166</td>
<td>5,237</td>
<td>9,403</td>
<td>4,773 CR</td>
</tr>
</tbody>
</table>

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NOTES:

1. Bonuses included above are illustrations only and are based on the rates declared by the A.M.P. Society at the end of 1979. Future bonus rates cannot be guaranteed because they depend on future experience. Bonuses once allotted, are guaranteed additions to the sum assured.

2. Loan Values are on the basis at present in use by the Society and are available immediately after the yearly premium due at the duration from commencement shown has been paid.

3. The Society's current rate of interest charged on policy loans of 11.00% has been used net of tax at a rate of 46.00%.

4. A gross yield of 20.00% per annum on funds invested has been assumed with allowance for tax at 46.00%.

5. The premium quoted is payable yearly, is applicable to a life accepted by the Society as a standard risk and assumes no additional benefits are included in the policy.

6. This column does not include allowance for the effect of the interest which could have been earned by the firm had the net outlay been invested in the business.
Office Organisation

The office is the hub of the Farm Business.

An efficient office system makes farm management so much easier. For an office to work it must:-

(a) be comfortable
(b) have aids which you will use. year planner, maps, market reports, work chart.

The office is an information centre. Its focal point is the desk. Desks need to be kept clear for working.

To achieve this -

(a) handle the mail as it arrives
(b) set up a filing system which is uncluttered but which provides easy storage and quick retrieval.

Farm details can initially be recorded in a diary and transferred to paddock information cards or a foolscap size photocopied farm map.

Financial details require regular attention. On a monthly basis:-

- enter up the cash book
- reconcile with the bank statement
- query or pay accounts and file the accounts paid.
- exercise financial control

Problems will occur, these can be minimised by operating to a system.

Set down what you want or you need to do in the office and then allocate times to attend to these things. E.G. select a day and a time during the week to attend to office details. Then you might allocate duties accordingly.

First week of the month - 1 hour - attend to non financial mail and physical records
Second week of the month - 1 hour - pay bills, write up cash book
Third week of the month - 1 hour - literature survey, physical records
Fourth week of the month - 1-2 hours - complete cash book reconcile, financial control and filing.

Setting up an office system that works for you is a challenging exercise which you will find beneficial and personally gratifying.
Planning

Planning the annual programme involves laying down on a planning schedule the anticipated physical quantities of produce for sale and materials required. See attached annual programme for case study farm.

Budgeting

Cash flow budgeting involves converting physical quantities into $ quantities and outlining anticipated months of receipts and payments of these dollars.

Summation of monthly income and outgo enables the net flow of cash into bank or stock firm current accounts to be determined for each month.

Accumulation of these changes (net changes) enables the period and amount of the peak operating deficit to be determined.

Equity

Equity is the net worth of a business or individual. To be determined, assets are added and liabilities are deducted. The result is your (or your business') equity. Business performance is measured in terms of equity growth. Cash surplus generated each year is only one portion of the business equity. A balance between equity and liquidity is important.

Gross Margin

Farm financial plans can be improved through the analysis of each of the enterprises on the farm and a weighing of the importance of each determined. Gross margins provide a guide to the profitability of each enterprise.

Partial Budget

A partial budget enables quick determination of the likely changes to the $ balance flow resulting from an anticipated change in enterprise emphasis.

Long Term Planning

When planning long term, it is important to estimate the anticipated surplus that can be generated from the home farm or amalgamation of farms if expansion is being considered.

The Year-In-Year-Out budget uses long term price forecasts to even out prices variations for produce sales. An inflation factor is included to account for rising costs.

The year-in-year-out surplus will need to be sufficient to account for seasonal variations.

The year-in-year-out budget for a static situation (once achieved) proves to be a helpful guide to long term viability and repayment ability on anticipated expansion programmes.
The Foundation

The Farm Management Foundation of Australia (Inc.) is an independent non-profit organisation providing management training opportunities for farmers.

1150 members receive a bi-monthly publication - Cornerstone, several planning charts and free access to the time of the Foundation staff for their individual enquiries. The Foundation does not provide an advisory service.

Principal training courses include:

A 30 day "Farm Business Management" Course scheduled as either

A course in block format in Spring, 3 weeks on, 1 week break, 3 weeks back on course

or

An Integrated course in 6 weekly segments during the year in late January, February, late March, July, October and February the following year.

A 15 day "Introduction to Farm Management" for young farmers, 18 - 25 years of age, who wish to understand the financing arrangements and finance flows in the farm business.

This course is in 5 segments each of 3 days spread over a year. Segments are conducted in February, April, July, October and January.

Short courses and seminars are conducted during the year in country towns as well as in Perth.

Foundation course costs are currently based on $33 per day. Membership is $25 per annum.

For information contact the Director of Studies, Farm Management Foundation, P.O. Box 51, Mosman Park. 6012. Phone (09) 335 3355.
THE THREAT OF A GHOST TOWN

K. Goss

My purpose is to help you realistically assess a likely future for Cunderdin. Will it suffer decline in population, business and social relationships like other small towns in the wheatbelt? Can you do something to help Cunderdin retain the functions you require of your town?

First, examine population trends in the centre wheatbelt, particularly Cunderdin. Second, look at a film which shows the extent and causes of population decline in Australian country towns and what some people propose should be done about this. Third, consider options for the future of Cunderdin.

POPULATION CHANGES IN THE CENTRAL WHEATBELT

While the rural population* of Western Australia is about the same size now as it was in 1961, it has declined as a proportion of the growing total population. In 1961 rural population was 25 percent of the total but in 1976 this had decreased to 16 percent.

Decline in population size has been a feature of most central wheatbelt shires since 1966. For instance, the Midlands statistical division (28 shires, one town from Beverley to Dalwallinu, Dandaragan to Yilgarn) declined by 693 persons or 1.3 percent from 1971 to 1976. When adjusting for births and deaths the net outmigration was 4,694 persons or 8.9 percent. The Upper Great Southern and Lower Great Southern divisions also had net outmigrations (6.8 percent and 2.0 percent, respectively) for this period.

The shires of Cunderdin, Dowerin, Goomalling, Kellerberrin, Northam, Quairading, Tammin, Wyalkatchem and York dropped from 14,471 persons in 1971 to 13,303 in 1976. This was a decline of 1,168 persons or 8.1 percent. For the same period Cunderdin shire had a population decrease of 14.8 percent (275 persons). The net outmigration would have been considerably greater in both cases. With the exception of Northam, these shires declined in population by 20 to 25 percent from 1961 to 1976.

However, shire population estimates since 1976 indicate that the situation has stabilized. The 1979 estimates were 13,760 persons for all nine shires, an increase of 457 or 3.4 percent since 1976, and 1,660 persons for Cunderdin shire, up 73 people or 4.6 percent. After correcting for births and deaths there has probably been a small net outmigration.

Are we seeing the formation of ghost towns in these wheatbelt shires? Population figures for Cunderdin, Goomalling, Kellerberrin, Northam, Quairading, Tammin, Wyalkatchem and York show a decline from 1971 to 1976. Dowerin, unexpectedly, gained in population size. However, again, there is an indication of stability in size of these places since 1976.

* The rural population consists of persons living in open-country and in places of less than 1,000 persons in size.
SOME CAUSES OF POPULATION CHANGE IN CUNDERDIN

An important factor determining which and how many places decline is the distance between these places relative to density of settlement on the land. When most of the central wheatbelt was opened up in the early 1900's, settlers were scattered on 1,000 acre (405 ha) farms which needed only a few central places. (Contrast this to the earlier settlement of 160 acre blocks in the U.S. where trade centres were located about 12 miles apart). However, wheat delivery points were located within 14 miles (20 km) and most sidings were seven miles (10km) apart. These were maximum, reasonable distances for horse drawn transport of grain.

Consider the original line between Northam and Kellerberrin. The average distance between the 12 sidings was 9 km and the six places - Northam, Grass Valley, Meckering, Cunderdin, Tammin and Kellerberrin - were 21 km apart on average. Most farms were an easy half-day's horse ride from their nearest town.

Then came changes in transportation. Horse drawn wagons gave way to trucks. Horse and buggy gave way to cars. Farmers could travel further in the same time to deliver grain and purchase supplies. Steam engines with their need for frequent water stops gave way to diesel engines. Increasingly farmers trucked livestock to Midland and backloaded with fertiliser. There were trips to Northam and Perth for those special shopping needs. There was no longer a need for trade centres to be 20 km apart.

Farm changes have also undermined the population base of wheatbelt towns. The number of farms peaked in the 1950's in the eastern shires and in the 1960's in the western shires. The number of farms in 1978 were about 15 percent less than the peak in western shires (Northam, York) but there was a decline of 20 to 35 percent for the other shires. Pasture development work came to an end and highly mechanized cropping partly substituted for sheep production. Consequently, less labour was required in the 1970's. The human resource in the hinterlands of these towns has diminished.

I expect that Grass Valley was the first place to suffer declining population, businesses closing down and people going elsewhere for social activities. Presumably Meckering was headed towards a similar situation when the earthquake occurred, and the need to relocate and rebuild houses and businesses gave people an option of moving elsewhere Many changes have occurred in Tammin in recent years. I counted six closed shops a few weeks back including the Co-op. Its population declined from 365 in 1971 to 288 in 1976 (a decrease of 21 percent).

We are now left with three major centres - Northam, Kellerberrin and Cunderdin. Are these places sufficiently far apart to share the needs of people in this region? If not, which will be the next place to go into decline? Will it be Cunderdin?

I have already noted that Cunderdin maintained its population size from 1976 to 1979. Why should this be so, when we know that population had decreased in the previous five years?
1. The financial situation in farming has improved. With better incomes farmers have been spending more on improvements and replacement machinery and this has helped the economy of the town. However, there has been no slackening in farm amalgamation. Three families left the area last year, and there were no outside farmers buying into the district.

2. Norm Alcock, Cunderdin Shire Clerk says that people are travelling a little less for supplies and thus doing more shopping in town.

3. There have been a few retired and active farmers move into town.

4. The age structure of the town has favoured natural increase. There is a large group moving out of their 20's into their early 30's, who have had children. I would expect the number of births to decline over the next few years.

5. There are a couple of areas of expansion. The Cunderdin Agricultural School has added to its staff and students. There is the sleeper factory outside Meckering.

6. Most importantly, I would suggest the transfer of business clientele from Tammin to here.

7. Another very important factor is the effort and enthusiasm that local people put into their community. Seeing the museum across the road I assume people have got more involved.

IS CUNDERDIN THREATENED TO BE A GHOST TOWN?

Having examined all these factors I suggest that while Cunderdin is enjoying stability in population size and business activity now, the pressures of decline are still there. The effect of age structure and the Meckering sleeper factory are temporary. The boost from the transfer of community functions from Tammin will gradually fade. The farm economy will continue to fluctuate. However, there are several insurances against population decline in the town - the agricultural school, the hospital and the shire office.

To me the situation for Cunderdin is in the balance. While most places of this size and location will probably decline, provided there are no policy changes regarding decentralization, not all of them will. You have a situation where there are options and local effort could make all the difference.

SITUATION

About half of Australia's inland country towns are static or declining in population. The smaller places are the most vulnerable.

WHAT HAS CAUSED THE DECLINE OF POPULATION?

1. Farm trends -- fewer farms and less labour associated with mechanization -- requirement for more specialized inputs from larger centres.
2. Town business trends -- less demand for business from the farm sector -- fewer businesses -- less jobs.

3. Transportation -- better roads and cars allow greater mobility.

4. Problems of the aged -- need to move to better health care and better amenities in larger places.

5. Problems of youth -- high unemployment -- need to move to job opportunities -- many dependent on social security in own town -- better entertainment in larger centres -- educational opportunities are elsewhere.

WHAT CAN SAVE SMALL TOWNS?

1. Energy crisis - probably not.

2. Decentralization -- Government policy on selective decentralization is essential - self-help is also needed - Government should take the lead by decentralizing its own structure - head offices to regional centres - branch offices to smaller places - new industries and services will follow - larger centres will have spin off benefits for smaller, adjacent towns.

3. Will to survive - unity and enthusiasm in the community.

A town cannot be saved from decline when the economic and social forces are overwhelmingly against it - the Government currently has a hands off approach and needs very good reasons to interfere - massive funds would be required to stimulate growth and there is not enough to go around.

It is unrealistic for many towns to aim for growth - Local Governments should concern themselves less with structures and more with aesthetics and quality of life - static communities do not have the problems of rapid growth - declining communities have a choice of concentrating on quality of life.

There are problems with attracting retirees because Government is simultaneously withdrawing services - must transport the aged to facilities.

4. Local Government - the Federal Government must spend more on Local Government - there should be a serious handing down of responsibility and funds.

CRITERIA FOR A GROWTH TOWN

1. Located in a region where there is a major economic activity providing jobs.

2. Have a reasonable population size and an appropriate range of services and activities.
3. Convenient location with respect to transportation and natural (tourist) resources.

4. Have spirit - "get up and go".

**CRITERIA FOR A DECLINING TOWN**

1. Small size - up to 1,000 or more

2. An eroding economic base or changes where the economic benefits are going elsewhere.

3. Lack of leadership and initiative.

Most towns that will survive are readily identifiable - they are larger and growing.

We are hung up on growth - a static town may be preferable, if there was a choice.

**THERE IS A NEW RANGE OF ISSUES**

1. We do not have an explicit policy for decentralization or handling growth.

2. There is a lack of ideas.

3. To what extent should we prop up towns and what form should assistance take?

4. Local Government has a lot of potential but is currently limited. - diversion of responsibility and funds should bring greater involvement in local administration.

5. There is the importance of the local community itself - community development approach needed - consider alternative strategies and make decisions - self-help - Local Government can co-ordinate - progress associations are a good idea.

**WHAT CAN PEOPLE AND COMMUNITIES DO TO HELP THEMSELVES?**

1. Must accept those things that cannot be changed and identify those that can.

2. Introspection - note the good things about the town, its functions and their future.

3. Set goals - growth, stability or decline.

4. List feasible actions.

5. Whole community should be involved in the planning and actions.

6. Work through political processes to get policy changes in State and Federal Government.
WHERE DOES CUNDERDIN GO FROM HERE?

1. We should not be chasing growth.

2. With good mass transit, shorter working week and desire for people to live away from the city, some might settle in this region.

3. There is a problem with greed among those in Local Government positions, local businesses and farmers - we should try to do what's best for the local community.

4. Farmers should sponsor local businesses more, particularly contractors.

5. Farming should and could become more intensive - by increasing yields rather than buying more land we will keep more families and labour on the land.

6. We should be more demanding through political and government channels - government is not doing enough.
"WHEN SHOULD I RETIRE?"  

M. Henning

When should I retire? When SHOULD I retire? When should I RETIRE?

These were the three questions I asked myself.

Each question carries with it a challenge to the family farm. But why a challenge?

Let us spend a little time defining the family farm in our own State. Western Australia is 150 year young. Not many families during the State's celebrations were in a position to look back more than four generations and the average broadacre farming family would be three generations with the fourth just emerging as your people.

Our environment is harsh. We have opened up base areas of land, rightly or wrongly, which have been put into production as quickly and as economically as was able to be done under the conditions which have prevailed during this period of history of our State. This pioneering of our primary industry was man's need to survive and to survive one must eat, I never cease to wonder at the drive, resourcefulness, courage and foresight of most of our pioneering farmers and their families. It was tough going but they had the love of their land and their industry within their hearts - and they had a future.

Over the ensuing years a radical change has taken place, where farming has evolved from an occupation of physical strength and abilities to one that requires more mental and emotional input - and what of our future?

Our family farms are no longer the farms of yesteryear where it was considered by many and envied by many to be a "Way of Life". It was most necessary for us all to have been put through this brainwashing "That our family farms are no longer a way of life but big businesses" to engender within us an awakening to face up to the changes and meet the challenges facing the family farm and this is why we can now, ten years later, look objectively at the three different areas of our businesses - financial, social and technical.

I consider, we have now met and accepted this first real challenge of a change in attitude that we have a farm business to run, but, I do not consider that because of this change we are to lose sight of the family aspect of our now "farm business". We are still considered by many and envied by many to have the best of both worlds. To my mind this change has brought about a new challenge facing the family farm. Family Relationships. The other areas have experts to advise us and guide us through the financial and technical problems that we encounter, but when it comes down to our family relationships we have in our own hands the responsibility of making or marring our whole farm family set up.

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As we grow older and more mellow we realise what the generation before us achieved, question our own performance and what we will relinquish to the next generation. Have we acted wisely? Have we acted responsibly? Can our experience be of some use?

As the second and middle generation farmers are now entering the 50 to 60 years old age group, they are the ones now facing these questions. As young men, it was expected of them to become a farmer and carry on the tradition of the family farm - or if his parents were far sighted and could afford to allow a freedom of choice of occupation, if nothing came of it, there was always the farm to come back to. The girls of this era, most times, married into the industry, if they wanted a life on the farm. Rank outsiders, like myself, started showing up, when the farm boys had better vehicles and could cover more ground in search of a mate. This is the age group which must face this new challenge of "WHEN should I retire?"

No two people ever re-act to the prospect of retirement in exactly the same way. We have people who can't wait for the opportunity to do all the things they have never found time to do, people who are worried by the thought of having to retire to give up the work they love but the majority of matured people are governed by their financial state as to when and how they can eventually retire.

The generation before us, the Grandma's and Grandpa's of that day had a strong urge to retire to the city of coastal towns, like Mandurah, Rockingham, to enjoy the comforts that were available to them there, such as health care, pension, water, power and a milder climate. In this period the farming situation was fairly stable, the weather normal, prices for wheat sheep and wool allowed an easier return for effort, as the cost structure had not reached the level it is today so there was a fairly good margin. A lot of beautiful homes were built for the older generation and the farms began supporting two units and this is where a great deal of financial stress started from in the early 60's. Wheat quotas were introduced, droughts and light years have been experienced, costs have escalated at an ever increasing rate until today, where we are approaching break even point, with most of our enterprises. Our simple life on the farm gone.

Suddenly, it has been replaced by a complex business enterprise, which has taken two generations to build. Where does this put the children of yesterday, the parents of today and the grandparents of tomorrow who have contributed their life's work to this end we, the 50 - 60 year old age group who are not really old, all things being equal, and most of us do not feel redundant or unwanted. There is still so much to be done on and around the farms, and if we are in good health, I cannot see the wisdom of leaving a home on the farm to set up another household in some place else. To what advantage? If we are fortunate enough to be serviced by the S.E.C. cold winters and hot summers can be made more comfortable as we grow older, time can be spent watching
coloured T.V. - especially after the satellite is launched. We have the back up of the Comprehensive Water Scheme for emergency water if we are not connected, the S.T.D. system, solar hot water systems and bitumen roads all moving in our directions. We have all worked hard through our voluntary organisations to have these services and we can now look forward to having the benefit of them and appreciate them to the full whilst we are on the farm. Health care is becoming more easily available to us, as young Doctors are coming to the country and being prepared to live amongst us for a greater number of years. This is a great relief and a very important factor as to how long we can remain on the farm. Extended Care and medical equipment are also being put into the Hospitals for our use. Do we really need to go?

About 10 years ago, I heard Bob Hall, Farm Advisor from Darkan give a paper and the one thing he said that day which has always remained with me was "That one generation was going to miss out". Last week I rang Mr. Hall and asked him if that was correct, he replied that he in fact was speaking about the pioneering farmer and quoted an old Italian proverb that goes something like this:- "To obtain the privilege of owning land, one generation was going to lose his life". If we stop and consider what this meant, we realise that he wasn't actually going to die, but if the farmer was prepared to suffer deprivation and hardship in order to achieve this ownership of land, he in fact, from then was holding the land in trust for his children. It was the basis on which to build his family farm. He had carved it out of the bush and with dedication had got on with his task in life.

We have dealt with the material things which affect our living, services which affect our manner of living, now the question is When SHOULD I retire?

Ask the family. Have a down to earth discussion regarding this problem and you may be agreeably surprised or upset by the outcome but which ever way it goes, it is better to have an understanding. Communication or as my father said "Talk to one another". It is the only remedy to solve the generation gap or in old fashioned terms misunderstandings and heartbreaks.

Both sides of the family are facing a new period in their lives. The children are big kids now, they have minds of their own and strong and weak points in their characters, we the parents have reached middle age plus and must accept that the farm is, as it is, at this point of time, whatever state it may be in, there are no ifs or buts; and whether our children like it or not it is the hard fact of life that we are their parents and have tried to do our best and this is the situation - our family relationship.
Once this set of values has been established with each respecting the other's position and point of view, conversation can be entered into but without emotion, without heated arguments and the like. It takes a lot for one to ask, "When SHOULD I retire?"

It is within this area that I feel we are going to have to accept a new change and thus a challenge to the family farm. We have all of a sudden started hearing this new phrase "Family Relationships" with its inherent problems. Attitudes and traditions must be put under scrutiny and family aims must be defined very clearly, so that a plan of retirement can be worked out to suit all. Each side of the family is under duress and the more units that make up this family business, the harder it is going to be to formulate any type of plan and action, but the situation must be looked at before any crisis arises.

There are so many facets to be considered, options to be evaluated, that the mind boggles when one starts to plan. We have to consider the needs and desires of each party.

As most of you are aware, C.W.A. has run four Courses such as this since 1978 with over 100 young farmers and their wives attending and there has been a common factor running through these seminars, of a discontented attitude towards the family set up, mainly by the younger ones.

There were exceptions at one course which consisted of an older age group up to 35 years of age, and most of these course members were managing their own properties and had young families of their own and their attitude towards farm management and parents was entirely different from that of the previous schools which had an age limit of 25 years. These older people were the product of father's retiring away from the farm much earlier, when they as young one's married or the parents retired after they had been home from school for a few years.

This group had not had any help from Government, their schooling was up to Junior level if they had been fortunate enough to have been sent away for three years and they were really keen to learn to cope with the business side of the farm. My observation was that they had been caught in the middle of change and had missed out on a lot of guidance and help from parents. These people are good farmers, but realise they have to learn to understand the financial side of their farming, and are setting about doing this. It was the attitude of the younger course members which worried me most of all, so the following Seminar was opened with a social issue because it appeared to me that understanding of each other within the family is sadly lacking and I feel it is more important at this point in time, than ever before.

The segment was entitled "Stress", by Mr. Goss and he was able to show us how during the last 10 years outside influences over which we have no control, weather, world economics, strikes, etc., had placed the parent farmers under this previously unknown stress factor which is causing a great deal of trouble within the farm family today.
We can no longer worry about the traditional type of retirement; which has carried with it a lot of unspoken problems; how many farmers once having stopped heavy work suddenly have just faded away within the first two years of leaving the farm? But on the other hand how many farmers in the last three years in our own districts aged between 50 and 60 years have died of sudden heart attacks? It is now we must start planning for the future and good of our own self and family.

Accept the fact that nothing is normal any more as we knew it and don't worry about what anyone else is doing but start planning now, time is running out.

We know from over the last 10 years phraseology has played a major role in influencing our thoughts. I've already referred to "The Way of Life and Farm Business" but I was very frustrated a few year ago to be invited to a Seminar at Muresk, entitled "How to Get Dad Off the Farm". Presumably it was intended to provoke thought. We don't hear that phrase as much as we did then, because it has become quite evident that there is a real place on the farm for Dad.

"Won't Let go the Reins" is another phrase. Sit down and talk about it, Why won't Dad and Mum let go the reins. None of us can see ourselves as others see us, and whilst Dad and Mum are waiting for the opportunity to start conditioning themselves to ease up on the physical side of things for a start, simply because of the ageing process, maybe the sons and daughters are not starting to equip themselves to take over the work load and show that they are reliable and responsible enough to carry on. There is no margin for error nowadays. "I'm getting out, I've had enough, What's it all about anyway". We've all been guilty of saying one of these things over the last five years. Perhaps we are thinking that it is easier to "Opt out" instead of "Sweat it out". It probably would be but we really want to see what it has taken two or three generations to build up, be sold up without a fight, to save our farms?

The T.V. has a lot to answer for. Over the years it has taken away the desire of expressions. It brings everything to us and we don't have to think about the exchange of conversation and communication. We have lost the art of having a personal view, whether it be right or wrong, but a view. Each of us is a person with a mind, use it, and the answer to when SHOULD I retire will evolve. Each farming family will have a different answer - we are unique and after having been brought up on a farm, working together, living together as young people and business partners, socialising and working together in the same community, I can't see why the question of retirement can't be solved without an emotional crisis and an upheaval. The time and manner of retirement is a personal appointment to be met by the people involved.
There are many options open to the Mum's and Dad's and usually the biggest factor to be considered is finance. It has become more and more difficult to save for one's retirement over the last decade, as most of the income generated from the farm has been required to keep the farm viable and the tax system doesn't allow for personal savings to any degree, because of this the family must come to grips with the hard facts that under the present economic conditions, to set up and maintain another unit which is unproductive could be a very costly venture. More than likely a helper would need to be employed to replace Dad and that would not be less than $200. per week, plus a sum of no less than $50. per week for a maintenance amount for Dad, which would mean an added $10,000 per year for the farm to find, and maybe not a great deal more produced.

Providing good health is being enjoyed, my opinion has always been that there is a real need for that extra pair or two pairs of experienced hands just when the young people are setting up their own homes and starting their own families. Attendance at Courses such as this, workshops etc can be arranged far more easily if there is someone at home to carry on, nevermind at what pace, but just someone being there. Holidays too, can be arranged without a cash outlay for caretaking which is not always reliable, and many more advantages.

This opinion was substantiated whilst I was in Germany recently. I was taken to Segeberg in Schwelswick Holstein, one of the richest farming areas in Europe, where land has reached a value of $10,000 per ha. yes, $4,000 per acre (average size farm 28 ha). The family lived in a beautiful two-storied home, which the farmer-contractor and his wife are redecorating. They have two sons, 13 yrs and 10 yrs old. The eldest boy has a special licence to drive their Mercedes Benz 4 wheel-drive tractor to the farmlands which are separate from the farm houses and Grandma and Grandpa live in a small brick and tile home next door, without a fence separating the houses. They have their own flower and vegetable garden and are kept an eye on respectfully and lovingly by their children and grandchildren. I couldn't help but notice this attitude towards the old people wherever I went in Germany. They were still very much a part of the family scene.

In this area, where a great deal of rape seed was growing and just ready to flower, everything looked efficiently run. The houses were beautifully kept, the sheds and machinery were very tidy and so cleanly kept, farmyards were cobbled and there was just no scrap heap or waste space. This particular farmer - was a contractor as well which gave him added business and confidence to have his eldest son work with him in the future. This boy could speak English and had no hesitation about his future in coming home on the farm. Just off the kitchen, the boys had a very well equipped bench for wood work, and it was their grand­father who was teaching them the skills. It was quite obvious from the beautiful staircase and other work in the home, that their father could work with wood also. But it was Grandfather who was keeping the art alive.
I was also taken to a school or rural home economics for girls aged 18 - 23 years. They board privately in the township and attend the school daily from Monday to Friday. The value of an efficiently run home being so important to the management of the farm, was quite obvious and most of the farmer's wives in that area had been through this school, so they understood the role that was before them. I can see the need arising for such tuition in our rural areas, but until that day comes, I'm sure a grandmother who has met the change of a woman's role in agriculture will be able to ease a lot of frustrations and help the younger women on the farm. The other farm which I visited was in a south-easterly direction from Hamburg and by our standards, this too was another beautiful two storied home, but this family, and they were all involved, have had to resort to tourism to help remain viable as they had been forced into a pocket by the Russian Wall and the farmlands had been cut in two. Further on the railway siding had been closed and a barbed-wire entanglement which was the wall, crossed the track, which meant that there was no outlet for their produce and it was referred to as a "dying town". In actual fact I am sure from the projects I saw being undertaken, they will be gearing the district up for tourism. So really our problems are not so different in many parts of the world; but the causes are and we want to take heed and learn from each other.

We were warned when entering the 1970's that pressures would start to challenge the family farm and these have built up now aided by the weather. I feel more strongly than ever, that the 50 - 60 year old farmers and their wives have a very definite role to play in positively helping themselves and their families by remaining on the farm during the 80's.

I would like to see a retirement plan properly drawn up by the family. Take Stock. Set about identifying your resources.

1. State of health - the most important factor.
2. Marital state.
3. Family relationships
4. A complete review of the financial situation of the farm; Assets, liabilities, debt structure percentage of equity.
5. A list of personal assets and liabilities.
6. A revision of all insurance policies being held. As there is a problem area between the ages of 50 years and 70 years when the social security allowance is available, self-employed superannuation policies could be taken out with the object of having one mature every five years from 55 years onwards until the age of 70 years is reached. Premiums to be found by the farm. This would relieve the farm of the necessity of finding a lump sum at retirement.
7. Estate planning to be continued as it is most necessary even though Probate duties have been abolished. Don't be lulled into a false sense of security. Especially with murmurs of equal distribution of wealth - another phrase, starting to rear.
8. Reprogramming work proportions and responsibilities for the family as a whole.
9. Venue for full retirement and a planned approach to housing
10. Age of full retirement with personal satisfaction and achievement.

By this time a very positive attitude towards retirement should exist, and as elderly people able to adjust to a different lifestyle and standard of living. The wife is entitled to retirement as well as she has made sacrifices during her lifetime and worked hard establishing the property, rearing her family, and become more involved with the management and office work.

An agreement must be made to share the household chores so that resentment doesn't build up and mar a happy retirement for them both.

When should I RETIRE? Personally, I am looking forward to this phase in my life, with my husband we can start easing our work load. In fact, we have just commenced the programme as outlined above and also next Saturday we are off to Geraldton for a week to enable me to attend the C.W.A. Conference. Several menfolk are going so we have a pleasant time to look forward to. We shouldn't be going, of course, there's this and that to be seen to, but I feel that if we don't make a start, we will never make time to do these things.

Our shearing was shared this year, one daughter-in-law worked in the shed full time and the other one and myself looked after the men's meals, in it wasn't a big task for one person looking after 8 men for 2 weeks. I'm looking forward to this co-operation with our work in the future. I have started to involve the girls with the office work but they are not over enthusiastic at the moment and whilst I'm prepared and able to cope, I will endeavour to teach them gradually as time goes by. As far as my home goes, it is the first time ever that my husband and I have been on our own so that is quite an exciting thought even at our age.

Being on the spot and being able to help care for our grandchildren is another aspect which I consider most important - the security of the extended family. My husband can see to so many jobs as maintenance, stock, water supplies etc. and leave the boys free for their field work and to cope with the changing practices of agriculture. There are so many ways in which our experience can be used to our advantage for the whole family in the financial, social, technical spheres and I would add yet another vital area from now on - political. We can be the watchdogs of our industry so that we can make ourselves more aware of what is happening, by reading, listening spending far more time researching, be well-prepared, well informed so that appropriate action can be instituted through our local organisations and politicians to safeguard our farms, and enhance the quality of life in our townships. If the time comes when unanimous decisions cannot be made by the family members, we can always turn to the appropriate expert and ask his advice as an objective opinion can usually be given.
I feel excited about our semi-retirement and feel we are going to attack the 80's with confidence and enthusiasm and get on with the job of working together and survive as a family and face up to the challenges and forces which are working insidiously to attack our family farms.

When my turn comes, I feel I shall be ready to retire fully, knowing that we have done our best towards the survival of our family farm.
ACTIVITIES THAT KEEP ME HAPPY

P.M. Smeeton

If any woman is to succeed as the wife of a farmer, pastoralist or grazier, she must have a sense of humour, without one, she may as well give up the thought of marrying that handsome hunk of Australian manhood who lives in the country and go and get hitched to a city 'slicker'. No words of wisdom from anyone about what she should or shouldn't, can or can't do, will overcome the lack of this basic requirement.

If the family farm is to survive it needs women with brains, staying power, good health and that aforementioned sense of humour. For some reason the life in cities is promoted as the ultimate. Why, I will never know. Because life on a family farm offers so much that no city dweller can ever experience, the obvious advantages such as living the way one wishes, the wide-open spaces, clean air and the greater involvement of all the family. The disadvantages are there too, sending children away to finish their education, the dependance on the vagaries of the weather, the lack of control of what we get for our produce and so on.

One of the ways of being happy is to accentuate the positive and so we must look for ways of doing so. I am city born and bred and I can still remember how lonely I felt when I first went to live on a farm near Wongan Hills. It was quite a surprise to me this lonely feeling, more for family and friends than for a certain ¼ acre block in Mt. Lawley where my mother and father had created such a happy home.

So I can understand that other women can feel disorientated when coming to live in a rural area, and it takes time to meet people and find the ones you like and to adjust to the fact that the man you married expects you to be as knowledgable as his sisters who were reared to farm life.

The very first lesson every woman must learn in order to remain sane is that handling sheep brings out the worst in men, great husbands though they might be. Any woman who can survive the trauma of varding sheep and doing everything wrong, every time, for all time, can then go on to do with great joy the things that make her happy, there just has to be a plus for such a minus.

I had two children in what was considered by my family to be indecent hast - as did so many of my contemporaries. It wasn't a case of doing things to keep one happy, it was just a case of cooking, washing, cleaning etc. But gradually one learns to cope and eventually you find that you actually have five minutes to think and wonder what you would like to do with that wonderful leisure. And so you start right where you are - at home.
We all owe a debt to Farm Management Consultants because they made farmers realise that their wives were not only, cooks, housekeepers, nurses, keepers of the poultry, sheep herders, fitters assistants, mothers, wives, movers of machinery, taxation deductions etc., but that they really could contribute to the management of the farm. So here is the first activity in which women can participate if they feel so inclined. Right from the beginning of my life on the farm I wrote out the cheques and paid the accounts, after my lord and master had vetted them. It was some years before I was allowed to do this automatically. Things have changed and now it is the accepted thing for women to help with the book-keeping and perhaps actually have a say in the running of the enterprise. This depends on both the partners, but over the centuries in our European culture most women have managed household finances so it is only a little step to assisting with farm finances and record-keeping. So ladies if you have any nous at all get yourselves interested in the management side of your family farm.

It is an absorbing pastime and one in which you will feel, as I did when my husband was alive, that I was really making a contribution to the life I liked. These days we employ both Farm Management Consultant and accountant, but my cash book provides the information for budgeting.

Of course we are not all alike, figures can be an anathema to both men and women and so you would like a different interest. Perhaps animals are a source of interest to you - from the country newsheets it would appear that women are winners in the management of Angora goat studs, and a few have ventured into the field of sheep, cattle and horse stud management. If you don't want to be involved in the upper echelon of animal management, why not improve on the grass-roots level and make those fowls pay - a neighbour of mine has taken on raising meat birds, about ten weeks intensive feeding and then you can get out the cleaver, behead them, remove feathers and innards and sell them to your neighbours to enjoy a real fresh chicken dinner, quite a different taste to the frozen variety. Then there are pigs, a bit smelly, but such interesting animals. We had them for about three years and I found them entertaining, greedy, friendly and eventually a bit much to cope with at busy times when my son was putting in the crop without help and the pigs came into my orbit entirely. I still miss the interest of these much maligned animals and they can be very profitable. It has always seemed to me that women could be more involved with sheep-dogs, both in the raising of these important farm workers and the training of them. After all they, the dogs, contribute so much to making sheep and cattle work easier for all the family. I can't imagine life without them. If you have a sincere interest in any animal you can derive much pleasure from breeding and raising them, not only will you get satisfaction you can also get a financial reward for your endeavours. If you wanted to do the thing properly why not do a course of animal husbandry through a University or Technical school or contact the nearest branch of the Department of Agriculture for a helpful hint or two.
On a hot summer's day there's nothing like the sight of a healthy green lawn beside the farm home. It can give pleasure and refreshment to all members of the family and make worthwhile the effort of maintaining it. Today we are making greater use of indigenous flora, as we should, but that green stretch of buffalo only adds to the charm of a garden.

Keeping that lawn looking immaculate is generally regarded as a male chore and the flowering part of the garden as 'mothers'. Digging and weeding a flower-bed is a means of restoring equanimity to my life, half an hour with my hands in the real earth and my frustrations depart, and the garden benefits too. There are some really beautiful gardens in our hot wheatbelt areas, lovingly planted and tended by the lady of the house. Even if you haven't a 'green thumb' an ordinary one and dedication can produce results that will make anyone think that gardening is an activity that will produce happiness.

There has been a great deal of talk and some controversy about salinity and its effects on our land and water. I am not going to get publicly involved in an argument about who is right and who is wrong - I have already done so. But I am going to say that we all must try to stop the spread of salt in our areas. For the past ten years my son and I have planted thousands of trees, not all of which have grown, as well as taking other measures. We have walked hundreds of miles, planting tamarisk cuttings in the approved manner, and also hundreds of miles planting young eucalypts. Sometimes it was very cold and very wet and you wondered why you were bothering; however we now derive much pleasure from our trees and also much pleasure from comparing treated salt areas with nearby untreated areas. On other farms I have seen like enterprise, Mrs. Hall can show you the difference made by extra trees. We have reached the stage where we plant at least 200 each winter. I have also taken part in planting puccinellia and other salt-tolerant plants, fencing off the areas so sheep are kept out and generally learning as much as I can about ALL methods of treating salt. Anyone can extend their interest from the home garden to the further reaches of the farm, and you can combine the two by growing your own fruit and vegetables.

The Queen Mother once said 'The service you give is the rent you pay for your room on earth.' Whether she was quoting from something she had read, or whether she coined the phrase does not matter, what does matter is that attempt to do something to assist others. One of the easiest ways to accomplish this is through organisations. Quite often you don't have much choice in country districts, a neighbour will take you along to the meetings she attends and whether you like it or not you've become part of the local scene. This is especially so in the smaller towns.
The very first meeting I attended in Wongan Hills was that of the local Anglican Church Guild - and without being allowed to draw breath, the Mothers' Union. As attending church fairly regularly was an accepted part of my life, joining these two church organisations appeared to be fairly innocuous and obviously was expected of one. I had no idea how these first rather hesitant steps would enlarge my life. Because I discovered that I enjoyed going to meetings, not only the fellowship with like-minded people but also being able to contribute to furthering the aims of each organisation.

Whether you are interested in a church or not, the one common starting point for all young mothers is the infant health centre, where you meet and make friends with your own age group, where you get involved in raising money for the first time - it's a habit you have acquired for the rest of your life. Making cakes, biscuits and jams, small boys' shirts and pyjamas, pretty dresses for little girls, all to be sold at street stalls or garden fetes - all for good causes.

From the infant health centre you progress on to the kindergarten; you can enlarge your horizons here, not only cakes and sewing, but you can assist with the youngsters - you can become a 'help'. You also learn to realise the importance of those sticky pieces of butchers paper, and that the peculiar squiggle is meant to be you - you learn it was 'painted' with love. You also learn that the kindy teacher needs all the help you can give.

The next inevitable step is joining the P. & C.

However, everyone is interested in the education of their children (or everyone should be) and this is one group that the most timid farm lady should join. If you don't what right have you to complain if you don't agree with your child's treatment? Once again all schools are going to need much parental support, especially in the fund raising area. There is insufficient money available to meet all needs. At the National Conference on Rural Education last November organised by the Education Department of W.A. with backing from Organisation for Economic Co-operation and Development (OECD) and the Centre for Educational Research and Innovation (CERI), three of the propositions put forward and supported were:

In future more decisions regarding the organisation, structure and functioning of rural education should be taken in local areas by people directly involved.

Encouraging useful community participation in rural schools can be a major way of enhancing the relevance and vitality of those schools.

Structure and processes of rural education will be most effective when they capitalise on the strengths of the organisational economic and social environment of the schools.
Now if we, the community, are to play our part in this co-operation with the educational authorities someone - perhaps that very shy you - must be courageous and communicate with the local school hierarchy.

You will find that you have something to offer and your help could be of great benefit to our greatest resource, our children.

There are many activities centred on children that could not continue without the assistance both personal and financial of adults. Guides; brownies; scouts and cubs, flourish in country areas where there is a leader interested in these activities; when he or she departs there is a falling away of interested children until another comes forward happy to be associated with the group. This applies to swimming clubs, ballet, softball, cricket etc - its sometimes much better to commence with helping children, their lack of self-consciousness will assist you in your efforts to overcome any feelings of inadequacy. Your encouragement may produce a 'Queen's Guide', a Herb Elliott or a Shirley Strickland.

You get absorbed in your districts activities, you have the satisfaction of seeing the results of all that money raising - the final payment made on the loan for the clinic, the opening of the swimming pool, the newly painted church, the extensions to the golf club house (and you remember when it was only a tin shed) and then you find you are old enough to help inaugurate a bowling club - more fund raising. You also realise that the part that meant the most was all the fun you had helping at those street stalls on a wet windy day. I am NOT a golfer, but each year I help at our Club on a men's cup day - I spend the day washing up, but it is a day of relaxation and fun, you don't have to think while doing this chore, and I can chat with people I would hardly ever see elsewhere, and there is the interest of who is doing well out there on the course.

I have always been 'good at figures' and have been treasurer of most of the organisations to which I belonged. So it was with CWA - first at branch level, then divisional, on to being State Treasurer and finally State President. But it wasn't the positions that mattered so much, it was being able to contribute to the welfare of the people of our State. It was also a case of a shy person learning to express her ideas and becoming interested in the many facets of that wonderful Association.

Because I and 7000 other women enjoy going to CWA meetings, services for country people have improved during the last 50 odd years. In some cases it has taken a long time to achieve results but sometimes alone, and sometimes with other like-minded people and/or organisations we have seen our ideas brought to a fruitful conclusion. Most of you will be aware that this year the CWA was named the winner of the Gold Swan Award which 'honours outstanding work or service performed by an organisation of any kind'. The
accompanying certificate 'commemorates the presentation to the Country Women's Association of W.A. whose 55 years of caring and concern for the community was declared by the independent adjudicators to be a most meritorious achievement'. Some of the items listed in our application for this Award were -

Donating a fetoscope to the KEMH Research Foundation, conducting two seminars promoting Motherhood, conducting four Farming as a Business Seminars for your farmers, male and female, a Single Parent Support Seminar (assisting 9 lone parents and 23 very young children), assisting with Handicapped Children's Holiday Camps annually, distributing John Bamford Trust Films & Lectures on Natural Childbirth, donating two resource vehicles to the Education Department to assist in bringing teachers to remote areas, conducted Leadership Schools for Aboriginal Girls during the past 12 years. Conducted Nutrition Seminars for Aboriginal women of all ages, both in Perth and in the Kimberley and Pilbara regions, assisted many students from our Aid to Education Fund, sent housekeepers to many farm homes when mother is hospitalised, provided prostheses for mastectomy patients, and so on and so on. The other three speakers here from the CWA share my pride in these achievements. None of us could possibly see how our interests would be widened when we took the first step of joining C.W.A. - the Caring Working Achieving Group.

Not only can you be happy being involved in seminars or raising funds for worthwhile causes in CWA, you can learn a variety of handicrafts, join a choir or a drama group, have a home-away-from home at CWA House in Perth and/or become interested in it's international work. There is something for everyone in CWA.

To think I never wanted to join CWA - I only went along to please a friend, and very nearly decided I wouldn't go again - that was 25 years ago. The last seven years of my life have been dominated by my involvement at State level - but from now on I can relax and attempt to do some of the things I've been looking forward to doing for years.

All those marvellous books to be read, I'd like to know Shakespeare better and Henry Lawson and Patrick White. We were not taught anything about Australia at the school I attended all those years ago. Then there's silver-smithing in an amateur way, and I do so want to learn something about carpentry, it would be an achievement to make a small table. During these last busy years fitting in CWA with my farm duties, being my son's assistant at busy times, still seeing the same reactions in the sheep yards, doing the book-keeping, cooking, trying to reconcile rising costs with budgets etc. etc. I made it a rule to cease work at 8 pm. and I would watch TV and either knit or do some tapestry. Which brings me again to the handicrafts that interest so many women. Perhaps you too want to do something with your
hands, if the CWA can't help you, your town may boast an Art's group as our does - and it appears you can learn many many skills at these societies, just think of all that china you can paint. You needn't restrict your talents to china, there's nothing to stop you being a 20th century Rembrandt or a Renoir. Painting techniques can be learned and will be useful in promoting your talent. Another absorbing hobby which attracts many people is pottery - a craft that is centuries old, and the method of making has not changed much over that time. It is a relaxing and rewarding way of enjoying yourself.

Adult Education classes (called Technical & Further Education these days) have been the means of teaching many people many things from typing to metal work, from English Literature to Cordon Bleu Cooking. If you don't like joining organisations you can increase your knowledge at the local high school classes for adults, you can do a course by correspondence or you can fill in the gaps from school and matriculate through the Isolated Students Matriculation Scheme. If you really want to do something you will. A friend of mine who is the mother of six children, studied for a B.A. while rearing them and passed, and all the family benefited from her interest.

However if you are not a joiner, or want to go back to school there are always people around you who would love to talk to you. It's probably better if you are rather shy or quiet, they want to do the talking, your part is that of a listener, probably the most needed person in the world today. Everywhere you go you come across lonely people, sometimes it's their own fault, sometimes they are old and have never had the time to make friends therefore you can do much to help them and to help yourself by just dropping in to say hello to these folk. Generally the doctor or the matron of the local hospital can tell you who is in need of a friendly visitor. While you are up there asking for this information, you can pop in and say hello to the patients.

The final antidote to being bored on a farm is to seek employment in the nearest town. You need a co-operative family to do this and no doubt they will co-operate if your salary is needed to purchase improvements for the home or the farm. Part-time employment can be attractive to women if it brings them in contact with congenial work-mates, and gives them extra money for children's interest and their own wants. It takes away the feeling of guilt when spending money on non-essentials when all available cash is needed for essentials to grow crops etc.

No one is happy all the time, we need the bad times to make us appreciate the good and steel is tempered by fire, but each one of us can make our lives more worthwhile and thus enrich the lives of those around. So search for interests to counteract the humdrum hours - no doubt I'm preaching to the converts - the organisers of this week-long seminar hope you are happy being here, and that you will go home full of enthusiasm to meet the challenge of the eighties.
THE CANNING STOCK ROUTE  E. Lanagan

We left Billiluna Station, south of Hall's Creek, May 6th, 1940, to commence our trip down the stock route with 800 cattle, 55 horses, 12 camels, 10 native boys. Tom Kelly, Tom Baird, my husband and myself, the first white woman to travel overland from Billiluna to Wiluna through the Great Sandy Desert.

All stores and equipment for the four months was carried by the camels. Water was carried in canteens, each holding 25 gallons. The country traversed was mainly sandridge, the ridges rising 20 to 100 feet above the flats between them. There were many varied bushes, shrubs and spinifex. Where the ground was firmer and loamy there were thick belts of mulga and species of acacia and grevillea, some standing 4 to 8 feet high in the ever present spinifex. The wattles were in bloom and very lovely with branches hanging almost to the ground. There had been good rains and the spinifex had the appearance of a huge wheat field with the yellow stalks and ears of seed rippling in the wind.

We had the problems usually associated with such a long trip and no means of communication with the outside world. Water and feed were our main worries. Many of the wells had fallen in and this meant long stages between watering. We often had to cut and carry feed for the night horses. At no. 40 Well we saw the grave of Michael Tobin, one of Canning's party, who was speared on April 6th, 1907. In 1908 Canning erected a marble cross to his memory. At No. 37 Well we saw the graves of Showsmith and Thompson, the first drovers to attempt the stock route in 1910. They were speared by natives. The cattle made their way back towards Billiluna and most of them were picked up by the following drover. In 1939 my husband erected a post over the graves with the men's initials and a cross. Also buried here is J.V. McLernon who was with the Locke Oil Co., he was killed by natives 30 miles east of the Well in 1922. The graves made the native boys very frightened. Thick scrub came right up to the trough, the cattle were very timid and rushed away several times before being persuaded to drink.

The sand hills were so steep that it was necessary to traverse them in a zigzag manner, sliding down the other side fetlock deep in sand.

As my husband had enough responsibility with stock I decided to try the cooking. I had watched this being done and felt I could cope. Not being fond of damper I tried making bread. Fortunately we had a large dish with sloping sides. This fitted into a square camel box without slipping down. The yeast was mixed before breakfast enabling it to rise sufficiently to be made into dough before we left camp. The movement of the camel caused the dough to rise, there was no need to 'knock back' before placing the loaves into the camp oven for cooking. After four months on the track I became quite adept at bush brownie, jam and treacle tarts and other camp oven cooking.
We saw several groups of bush natives. These were kept well away from the camp as we were in the minority and had no way of replacing stores should they be stolen. One small boy edged his way near the horses. Before leaving Hall's Creek I had been given a packet of sugared almonds. I beckoned the child and gave him some, but to my horror he swallowed them whole. I had visions of him choking and the camel boys and myself being speared by irate natives, so I hurriedly plastered jam on bread and handed that to him taking the sweets away. I was rewarded with smiles all around.

The highlight of the trip was arriving at Durba Spring. After climbing up and sliding down sandhills for weeks it was delightful to come upon fresh water in a picturesque gorge approximately half a mile long, surrounded by lofty gum trees with green grass underfoot. We stayed a couple of days feeding and watering stock, washing clothes and saddle cloths and resting. The camel boys and I explored further into the gorge, quite beautiful with a permanent spring forming a natural trough at the base of the cliff towering over 100 feet above. At both gorges we discovered native drawings and tribal patterns. It was after leaving this lovely spot that we came upon mile after mile of Sturt Pea. Until now all water was pulled by whip camels sometimes taking up to 16 hours to water the 900 head of cattle, horses and camels. This brief rest in such surroundings put new life into all of us.

At the start of the trip I had assigned to me a boy of about 15 years. Baroo was to look after my horse and dig holes for camp ovens, make the camp fire etc. He could speak little English and I no native words, so we decided to educate each other. My first attempts were hilarious and Caroo rolled around in the saddle with laughter, but we managed very well and he taught me a lot about their customs and beliefs, also the names of different shrubs and their uses. I remember riding along one day and seeing a heap of sand neatly forming a heap. I pondered this for awhile but in the end had to ask Baroo, "What name that one?" He looked at me in disgust and replied, "Pussy cat". Oh well! Who would have thought of cats being in the Great Sandy Desert. Like most 'new chums' I made a few mistakes the most serious being when my husband could not leave the cattle and told me to go ahead and make the night camp. As we rode along I pondered this. I knew the camp had to be a large open space preferably soft ground with room for the camp fire and a tree of sturdy shrub on which to tie the night horses.

Baroo and I followed by the camel boys rode for some miles without coming upon any such clearing. At last in desperation I asked Baroo how one recognised last years night camp. Another incredulous look accompanied by one word, "S...t. Why hadn't I thought of that. Nowhere could we find a large patch of that matter. It was becoming dusk and I knew the cattle would be nearing their resting place, at last, in desperation, we made
camp on the largest open space we could find. I knew it was not suitable but it was too dark to go on. When my husband arrived with the cattle I was asked why on earth we had camped there. Too late to move so there we stayed with extra men on watch. Sure enough a few hours later there was a thunderous sound of cattle rushing off the camp. By lunchtime next day the mob were back intact. I was never asked to pick a night camp again. The most worrying part of the trip was when we reached sheep country near Wiluna. Billiluna cattle had never seen fences or motor vehicles and these alarmed them greatly. They would approach a wire fence timidly, nosing it and when the wire twanged there would be a 'rush'. There was no hope of getting them through gates, the wires had to be undone and several spans pulled out so that the cattle had plenty of room to walk through. Night watching was doubled, all hands were very pleased to reach Wongawol and Carnegie cattle country again. The cattle arrived in excellent condition, Numbering 778. 16 had been used as killers and 6 died from narrowleaf poisoning.
Problems facing farmers today are so abundant one hardly knows where to begin in dealing with them. Firstly it is no good wasting worry on problems over which we have no control. We must accept them and learn to live with them (e.g. the weather, a retarded child; our physical appearance). Let us put our energy into coping with problems we can do something about.

We all have a part to play, firstly by learning to cope with our own personal problems, secondly by dealing with the problems of our home, community and society, and lastly coping with our financial problems. I will avoid those things over which we have little or no control, such as national and international problems, but by being aware of tremendous troubles elsewhere we tend to forget our own trivial ones at home.

Sometimes the burden of our problems becomes almost unbearable. We all need help at times. We also know that feeling of elation we get when a problem has been overcome. Our experience then puts us in a better position to help others. I have lived long enough to have had some varied and interesting experiences. Naturally there have been tough times when there were plenty of sorrows but there have been good times too, with sunshine made brighter by the contrast. In learning to cope, not succumb to problems, one is helped by others such as good friends, wise counsellors and a few remarkable people who have the ability to inspire, but the greatest effort has to be your own. No one else can do very much for you unless you are prepared to help yourself. Easier said than done, but no matter how bad things are, one can always find another worse off. This may be poor consolation, but if one can come up smiling and say "It could have been worse", then the battle is almost won.

Let me console you by telling you some of the good things related to farming, in case you think all those problems I have been speaking about have turned me off. Not a chance! I wouldn't change it for any other way of life. We have built our retirement home on the farm and my husband and I feel we are semi-retired as we now just work - not slave. I wish you had asked me to talk on a subject I enjoyed such as "Planning a farm­house", because I planned every inch of mine, right down to the size of windows and position of power points. I am elated with my success as an architect and still amazed that my husband let me do it.

Life always provides consolations of a kind. This year, when the rain just won't fall in our area, has proved the easiest year ever for gardening. I can chip the weeds out faster than they grow. It would hardly be diplomatic to brag about it to the men in the family. They would much prefer a prolific crop of weeds as is usual.
A lot of city people, although they have very little understanding of farm life, have a yearning to live in the country, as is evident by all the farmlets in demand. Of course, they wouldn't have a hope of earning a livelihood from the land, which seems unfair. We have to produce enough to live on, whereas their excess profits from other ventures gives them the benefits, without the hardships, of country life.

They say the Queen is happiest when at her farm in Sandringham. That estate of twelve thousand hectares is probably not as run down as some of our properties, yet her pride and enjoyment of her animals and stud stock is perhaps very akin to our own.

For many years I have noted that the rich and the famous in Europe think that the ultimate aim in life is to own an old house in the country, and some even grow their own vegetables! We have had that privilege for years and thought very little of it.

For some, farm life is too lonely and they might never be able to enjoy it. With television, the telephone and radio, I don't see how one could be really lonely. I am extremely grateful to the A.B.C. for wonderful radio programmes over the years. Most farmers and families think the advantages of living on a farm outweigh the disadvantages. There has been a great weeding out among farmers over the past decade, and the ones left in the industry are the real bona-fide farmers, who I hope will stick with it, even though economic pressures are making life hard at present. Even if we are optimistic by nature, I think most of us would agree that the farmer is going to have a hard time for a few years yet, but it is essential that farms and stations are not abandoned. If we "survivors of the fittest" can't make a go of it, I'm sure no one else can.

We will continue to learn, to adapt, to change and to experiment to get the best from our farm. Our present adversity will perhaps at last unify us, to get together and present a united front, to state our policies with one voice and get a fair deal, along with the rest of the community for we are all interdependent in this complex society of ours. Be of good courage. I, for one, have faith in the future of farming.
Men and women are social animals. We tend to be "Group Centred". We define and understand ourselves by the groups to which we belong, or do not belong.

There is no way to over-emphasise the importance of INTERPERSONAL SKILLS of relating to our lives. Notice the word SKILLS. We develop these skills by the endless people we come into contact with throughout our lives. These skills therefore don't just happen as if by magic. SOMERSET MAUGHAN was aware of this when he wrote:


Relationships therefore reflect a "CONNECTION BETWEEN PEOPLE" and that this "CONNECTION" has meaning on both sides.

Human interactions or human relationships can be seen in every area of our lives:-

1. A FRIENDSHIP RELATIONSHIP
2. A FAMILY RELATIONSHIP
3. A LOVE RELATIONSHIP
4. A COMMUNITY RELATIONSHIP
5. A BUSINESS RELATIONSHIP
6. AN EMPLOYEE/EMPLOYER RELATIONSHIP

The Community Development Centre has for a number of years offered to the general public discussion programmes called HUMAN RELATIONSHIP WORKSHOPS, giving people the opportunity to look closely at their own relationship skills - to check them out - increase their own self awareness - to improve their skills. The Workshops are an educational programme and would contain such discusional areas as :-

1. DIFFERENCES IN PEOPLE
2. SELF RESPECT
3. KINDS OF LOVE
4. EXPECTATIONS

This reflects an overview of relationships and some of the necessary components which in essence could be seen in any type of relationship.
FAMILY RELATIONSHIPS

The family, as most people may well realise is one of the most basic and most important social INSTITUTIONS. Many would suggest THE MOST important social institution is any society or culture. Whether we are considering the AUSTRALIAN, ASIAN, EUROPEAN or AMERICAN culture; all have a FAMILY STRUCTURE in some form or other - it is basic to human existence.

Yet we have some DOOMSDAY PROPHETS who suggest the "FAMILY IS FINISHED" - "ITS ABOUT TO FOLD UP". However, there are others who consider the opposite to be true - that the family will become the most important area of STABILITY AND MEANING in this increasing UNSTABLE and EVER-CHANGING society we are now in.

Undoubtedly the family structure is going through change, just as other basic social institutions are - EDUCATION - GOVERNMENT - RELIGION. It is a social fact that in a complex social order such as the AUSTRALIAN SOCIETY, that when one part of society changes it tends to have effects upon other areas.

Nevertheless the FAMILY as we know it provides us with some, or most of our deepest needs and happiness. Without the family structure our sense of SECURITY, OF UNDERSTANDING, OF BELONGING would be severely threatened.

IF needs were being met within the family - one might well ask - "WHAT THEN IS WRONG WITH FAMILIES TODAY" - why is there so much family breakdown - why are so many teenagers leaving - what about the seemingly every increasing divorce rate - the conflict between generations - the "US" - "THEM" between parents and children. So this list could be continued.

OBVIOUSLY there is no ONE CAUSE. However there are two areas which are I think important to look at. But RECOGNISING there are other issues equally important.

1. HUMAN COMMUNICATION - There are many examples of typical remarks one hears within the family between parent and child, between husband and wife, between child and child. Of course not in our family - the Jones, Yes!!
"MY WIFE DOES NOT UNDERSTAND ME"
"MY HUSBAND WON'T LISTEN TO ME"
"I CAN'T GET THROUGH TO MY TEENAGER"
"MY DAUGHTER WON'T CONFIDE IN ME"
"I CAN'T STAND THE NAGGING AND BICKERING ANYMORE"
"I DON'T WANT TO START AN ARGUMENT, SO I DON'T SAY ANYTHING"
"MY PARENTS CONSTANTLY HASSLE ME - WHY DON'T THEY GET OFF MY BACK".

It is obvious that in many families and if we are HONEST - in all families from time to time, if not always, that family life is made unpleasant and frustrating by these destructive interactions or RELATIONSHIPS that are nearly ALWAYS the result of "POOR' or "NON-CONSTRUCTIVE" COMMUNICATION PATTERNS.
HUMAN COMMUNICATIONS can be viewed as the MORTAR BETWEEN THE BRICKS OF A WALL - without good mortar, or no mortar, one has a very poor wall. WITHOUT "constructive", "open" communication one has an almost NON-EXISTENT RELATIONSHIP.

Again the Community Development Centre has been offering community educational workshop programmes for people to come to grips with all the rapid change and how this change may well be affecting people's relationships. A programme called PEOPLE IN A CHANGING WORLD. There is also a programme called FAMILY AND COMMUNITY which aims to increase our awareness and understanding of what might constitute relationships within a family, recognising that "the family" is the first "community" any of us encounter and for many it is the most significant in our lives. These programmes are basically awareness building, with the basic idea behind them that through awareness we can change if necessary. That no-one can change "us" - the understanding too that "we" CANNOT CHANGE ANYONE - ONLY OURSELVES.

In the discusssional programme of FAMILY AND COMMUNITY some of the components might well cover areas of:

1. FRIENDSHIP - The opportunity to look at FAMILY FRIENDSHIP AND COMMUNITY to see how they are related.

2. BEING A PARENT - The different ideas people have about the role of parenthood.

3. HUMAN SOCIETY

Communication within a family is a test place for and a learning base for our communication outside. If we consider the family one of the most significant groups we belong to, it should therefore be as positive and constructive as possible.

Let us recognise the NO ONE is perfect, therefore no family relationships will ever be perfect.

One other area that we need to be aware of in terms of changing society is that Australia is an URBANISED society, and that urbanisation brings about pronounced changes in ways of life in nearly all spheres.

Urbanisation does not in itself mean "city living", although of course they often go hand in hand. Urbanisation in essence means COMPLEX SOCIAL RELATIONSHIPS whereas city life often means population size.
1. There is a tendency in urban living for the close proximity of many conflicting social norms and values. There is diversity of interests. There is the close proximity of AGE RANGES - OF RACE - OF OCCUPATIONS - OF ATTITUDES - OF VALUES - OF WEALTH on the one hand and poverty on the other, all within this close social proximity.

2. There tends to be rapid cultural change. A disregard for stability, loyalties of generation. "Traditions" and things considered "sacred" tend to dwindle in importance. Urbanisation has tended therefore to change:
   a. The Nature of Social Structures
   b. Relationships of people one to another
   c. Reduction in Family Size - "Molly and Me and Baby Makes Three" seem to reflect where our family is at present in many cases.
   d. Developing ideas of equality of the sexes - effects upon marriage
   e. Development of distinct peer grouping with greater age differences being seen - "The Invention of Adolescents" - Not always seen in other more traditional cultures
   f. All this tends therefore to a widening of Communication problems

3. MOBILITY - 100 years ago, or less, we perhaps just lived around our homes, not seeing too many strangers.

   Our present rapid mobility of travel of general movement in AUSTRALIA tends to:
   a. WEAKEN ATTACHMENTS TO THE LOCAL COMMUNITY
   b. WEAKEN FACE-TO-FACE CONTACTS AND THEREFORE COMMUNICATION
   c. WEAKEN CERTAIN COMMUNITY STANDARDS

   There are tendencies in urbanisation for:

4. MATERIALISM - External appearances and possessions become of primary importance, where perhaps we are judged more on our GADGETS than on our relationship values.

   There is the tendency also to the ultimate development of:

5. INDIVIDUALISM - The regard for SELF-EXPRESSION as a paramount in social relationships. The "I" comes to replace the "WE" sense of co-operation.

   Again these areas tend to lead to degrees of impersonality and decline of intimate relationship and communication.

Again there is no single answer. These are changes in our society. It is not a question of seeing them as BAD or GOOD. We need some basic awareness of how they are affecting our lives and our relationships. We need to develop self-awareness that we are individuals, and as families can appreciate some understanding and see some sort of order in society.
1. Courses Available for Year 10 Leavers

(a) Agricultural Wings

**Course**

Seven certificate of Secondary Education subjects are available - General English; three agricultural theory subjects: Animal Husbandry, Crops and Pastures, Farm Economics and Management; two workshop subjects: Farm Constructions, Motors and Machines; and one fully practical subject: Farm Practice.

The Certificate of Secondary Education is administered by the Board of Secondary Education. It covers all two year courses conducted in Years 11 and 12. Some of these subjects can be used to qualify Year 12 leavers to enter tertiary institutions and are called "Tertiary Admissions Examinations" subjects. None of the subjects offered at Agricultural Wings is a TAE subject.

**Eligibility**

Entry requirements in order of selection pressure are:

* Completion of Year 10.
* Satisfactory Confidential Report from the current (usually Year 10) principal.
* Academic performance
* Ownership - access to farming property.

Applications number about 200 annually for 150 places (130 prior to the opening of Cunderdin's new dormitory in 1979) and the third and fourth selection criteria are used most but not exclusively.

**Closing Date**

October 31, the year before the commencement of the course.

Appropriate forms are available to schools from the Agricultural Education Branch and if returned about the end of Term 2, preparation of applications is made easier. After receipt of a completed application at Head Office, the principal of the school being attended by the applicant, is forwarded a Confidential Report form for completion and return to Head Office.
(b) **Agricultural Studies**

A year 11 and 12 T.A.E. subject offered at 15 Government and independent schools. It has a minimum practical agricultural skills component.

Agricultural Studies is designed to be offered as an ordinary Year 11 and 12 subject at any school which offers such courses.

(c) **Technical Education Division**

**Colleges**

Geraldton, Fremantle, Albany and perhaps in 1981 Bunbury, offer one year full-time Certificate courses in agriculture and related subject. Woolclassing and Sheep Husbandry have been the traditional subject. More recently, Agricultural Machinery has been added. Applicants for most of these courses are from local townships rather than farms and are recent school leavers.

**Technical Extension Service**

A wide range of subjects leading to several certificates in agriculture and related areas are available by correspondence, usually as 15 and sometimes 20 lessons. Most enrollees for these courses are in the process of completing prescribed qualifications to enable them to secure promotion in their chosen employment.

**Short Skills Courses**

In 1980, T.E.D. introduced a pilot scheme at Wagin for conducting short skills courses in agriculture and associated areas of employment. The scheme has been regarded as highly successful. Most courses have run for one day, some for the evening and a few for more than one evening.

The officer in charge of this scheme is to identify the local need and arrange appropriate local (usually) persons to conduct the skill school at a local centre such as a workshop, farm shed...

Operations are centred in the Wagin district, but extend to Dumbleyung, Katanning, Yealering, Darkan and places between. It is hoped to establish similar schemes at other centres some time in the future.

(d) **Morawa District High School**

Offers several subjects offered at Agricultural Wings and has a residential facility. Morawa has a small farm and is currently hoping to acquire sufficient land to offer a course similar to that offered at Agricultural Wings.
(e) Gnowangerup Agricultural School

Traditionally, this has been a school with a two year course for up to 24 aboriginal boys of Year 9 - 10 age. There has been a continued and sustained decline in enrolments from aboriginal students which led to only six or seven students in residence near the end of the school year.

Commencing from 1978, some places for non-aboriginals have been made available. Students ex Year 9 and who are low academic achievers have been preferred.

A new role is emerging for Gnowangerup. The agricultural component of the course has been improved with an emphasis on hand skills. There has been some pressure to conduct a one year or perhaps shorter course, for ex Year 10 students, and perhaps but not necessarily, for students from farming backgrounds.

(f) Terminal Year 11 Courses

Several country high schools that conduct such programmes include agricultural components, sometimes very large components.

It is planned to prepare a teaching guide of suggested topics, their content and methods for covering each topic for a one year terminal course in agriculture for six or twelve 40 minute periods per week. The intention is to prepare more topics, more content for each and more methods for each, than could be covered at 12 periods per week. This would enable schools and teachers to select topics, content and methods appropriate to their particular student group's interests and needs.

2. Courses for Years 9 and 10 - options

Four Agricultural Options have been prepared:

- Animal Husbandry
- Cropping
- Horticulture
- Farming

Structure

Each has been prepared so that one option "unit" requires completion for two parts. The first part is suggested as being 'compulsory' and includes an introduction to the subject concerned. The second part can be selected from several other listed parts. In all cases, there is a suggested content component and suggestions for visits, visitors or activities.
It is intended that more parts will be prepared as well as teacher notes for assisting with presentation of the material.

Resources

The animal, cropping and horticulture options can be conducted with a minimum of expenditure, usually for fencing and water supplies. Most schools manage to arrange for the local Shire Council to provide a few acres of land or use part of the school block. Stock are usually donated and sold at the end of the school year, and machinery lent.

Our Branch can offer some money, quite extensive teaching ideas and plenty of encouragement. The initiative, enthusiasm and support usually comes from staff and community.

3. Teachers of Agriculture

With the rapid expansion of the number of schools offering agricultural subjects a serious shortage of teachers of the subject has developed. Any teacher in any secondary school requires a degree or the equivalent in a subject area and a teaching qualification, to enable him/her to teach and to hold the expectation for the "routine" promotions.

For Agriculture, this means the degree of Bachelor of Science (Agriculture) for the University of Western Australia, or Bachelor of Business (Agriculture) from W.A.I.T. at Muresk.

It is unlikely that all students who may wish to follow this aspect of Agriculture know of this possibility.
The farmer and the Rural community are probably more prone to certain Health Hazards than the Urban dweller. Some of these are listed below:

**Accidents with:** Machinery Firearms Drowning Animals

**Infections:** Tetanus Impetigo

**Cancer:** Skin cancer

**Allergies:** Asthma Dermatitis

**Chemicals:** Industrial Poisons

**Others:** Deafness Back Injuries

Conditions which affect the health of the whole community are also of considerable interest to the farmer, as the affect of some of these can be controlled or minimised by the people themselves. The ones which we will discuss later are; Heart disease, Cancer and infectious diseases.

Discussions of the above:

Accidents with machinery are common. Tractors, Augers and other machinery with cogs and V belts result in death and injury to farmers, their families and employees. A lot of these can be prevented by proper care and young children have no place in an area of danger.

Firearms are common on farms and gun shot wounds frequently seen due to the loaded fiream or mishandling.

Drowning occurs mainly of your children in dams and wells and now we have swimming pools to contend with.

Injuries due to animals are never ending. Kicks, bites and falls. Also snakes and red backs.

Infections on the farm are very similar to the rest of the community, though tetanus and skin infections are more common. Tetanus can be prevented by vaccination.

The affects of skin cancer can be minimised by clothing, ultra-violet screening compounds and much disfigurement may be prevented by early treatment cf skin lesions.

Farmers wives also subject to these.
Chemicals are playing an increasing part in farming and must always be handled with care and according to instructions.

Poisoning is still seen due to fuels and Strychnine.

Industrial deafness on the increase. Ear muffs should decrease this trend.

Back injuries very common in farmers and are probably due to lifting heavy weights in awkward positions.

Conditions which affect the whole community:

Heart disease; It has been shown in recent years that certain factors predispose to coronary heart disease. These are; high blood pressure, cigarette smoking, high cholesterol and tryglycerides, obesity, diabetes, oral contraceptives. Inactivity is a very doubtful factor. These so called "Risk Factors" should be viewed with the family history and your age and sex in mind.

Cancer; Evidence has shown that the incidence of lung cancer is almost certainly increased by cigarette smoking.

Infectious diseases are mentioned because by proper immunization a lot of ill health may be prevented. The following vaccinations should be given to all children, unless there is a likelihood of an allergic reaction to the serum. Tetanus, whooping cough, Diptheria, Polio and measles. Also all women who have a negative Rubella test, should be given Rubella vaccine before contemplating pregnancy. B.C.G. should be given to groups who are likely to come in contact with Tuberculosis if their Mantoux test is negative.

Also concern is growing because of the increasing use of drugs. Excess analgesics or pain killers result in a number of complaints including Kidney disease. Sedatives decrease the awareness.
SPRAY SEED ADVANTAGES

1. SPRAY SEED is the trade name given to the mixture of two chemicals, REGLONE and GRAMOXONE. REGLONE is the trade name for Diquat, and GRAMOXONE the trade name for Paraquat. They both come from the group of chemicals known as Bipyridyls. SPRAY SEED is the trade name for the mixture of 12.5% w/v Paraquat and 7.5% w/v Diquat plus wetter.

2. The Advantages are those derived from using Direct Drilling techniques. The advantages are as many and as varied as there are farms.

SPRAY SEED is a drum of chemical - nothing more. Just a tool in the revolutionary techniques of crop establishment known as Direct Drilling.

Now I'd like to give you some background details on these two points:

THE REVOLUTION

Like most revolutions that have succeeded throughout history, the revolution in which we are taking part right now owes its success to a need for change. The speed at which it succeeds is largely governed by two things, first and foremost the deep-inbuilt-prejudice to change inherent in all of us, and secondly, how great the advantages are that are offered to us by taking part in that revolution. The process of Direct Drilling began when the first stick was used to make a hole in the ground in which to place the seed. What is now called conventional crop establishment isn't really that old.

In 1701, Jethro Tull, an English farmer, invented the seed drill which sowed seeds in neat rows, saving seed and assisting weed control by allowing cultivation between the rows. That system continued for 250 years. We still sow in rows, but the weeds are now killed mainly by chemicals. So, what part of the conventional system are we revolutionising and why?

Firstly, we are eliminating the need for cultivation prior to seeding by hard grazing to keep the weeks small and then spraying with a small amount of chemical to control the weeds in readiness for seeding. Why should you do it? If you examined what harm you are doing to the zoology of the soil when you plough, at the same time ask what you are doing to the soil structure by cultivating continuously, you'll very quickly come up with 2 advantages of Direct Drilling.
THE ADVANTAGES OF DIRECT DRILLING

1. It can cut labour costs.

The first labour cost it cuts is the most important. Your own. You'll spend less time on your tractor. So, if you wish, you can crop more land. Or free up your time for the thousand and one jobs around the place. And it also reduces the need for hard-to-get, expensive-to-buy casual labour. In fact, many farmers who Direct Drill find they can comfortably manage their entire crop establishment programme by themselves. Another important saving is fuel. Naturally if you spend less time on your tractor you spend less money on fuel.

2. It can reduce soil erosion.

By not overworking the soil benefits of reduced wind or water erosion may be observed in the space of one or two years. This of course adds to your crop output. Another profitable side-benefit of reduced cultivation is improved 'trafficability'. You can be sowing straight after a heavy rain while your neighbour can't get back on his land. Also, reduced cultivation allows organic matter to build up. An ideal environment for soil-improving organisms like earth worms, which incidentally SPRAY.SEED does not affect. And naturally, with Direct Drilling there's less compaction of the soil. In all, less wear and tear on the soil immediately reduces the risk of erosion, and in the long run, improves soil structure.

3. It can extend machine life.

The beauty of Direct Drilling is that most farmers can do it with their existing machinery. But that's just the start of it. As you use your machinery less, say two passes per paddock instead of three or more, there's less wear and tear, less breakdown, and less downtime for repairs and maintenance. So maybe you can put off buying new machinery for a good few years. And that means when you do buy, say a new tractor, you don't need to bump up the horsepower. You might even decrease it! In other words, just by working the Direct Drilling way, you start to reduce your capital costs.

4. It can help you run more stock.

When you Direct Drill, you automatically increase your farm management flexibility. For example, normal cultivation eliminates grazing for a certain period before sowing. However, with Direct Drilling, from the break till spraying you can move many or all of your stock off your pastures, and put them onto your paddocks to be cropped. This gives you two very valuable benefits: One, your sheep are preparing your crop paddocks for Direct Drilling, because consistant hard grazing is essential before spraying. Two, your pastures get a better start and subsequently are able to produce more feed. Therefore you are able to carry more stock, during the autumn, or throughout the year.
It can help you grow more crop.

The Direct Drilling system lets you sow at the optimum time. So the first benefit you'll see from it is closer-to-optimum yields per hectare, because late sowing depresses yield. It also lets you do the job quicker. So you can plant more crop near the optimum time. In fact a lot more if you've got the land. Direct Drilling also allows you to wait until sowing time before you need to finally commit your area to be cropped. So you are better placed to adapt your programme to suit the prevailing seasonal conditions.

It won't cost a fortune to prove it works on your farm. For a start you probably have the basic equipment already. It's unlikely to cost you more than a few hundred dollars to prove how well it works on your farm. The full benefits of Direct Drilling won't be gained until you adopt the system on a whole farm basis. However, to get you accustomed to managing it, we suggest you start small. (Even a paddock of 50 - 100 ha should suffice).

ICI's continued research into crop establishment techniques over the past 20 to 15 years has led to the development of Direct Drilling with SPRAY.SEED. This technique eliminates the need for cultivation prior to sowing. It simply involves spraying with SPRAY.SEED to kill the weeds, followed by Direct Drilling into the unbroken ground with the combine. The area to be cropped should be heavily grazed continuously up to spraying. Direct Drilling has been made possible by the fast acting, non-residual herbicide SPRAY.SEED, and the active participation of numerous farmers and other organisations in the development programme.

*ENVIRONMENTAL ASPECTS

All studies have confirmed that basically SPRAY.SEED has minimal effect on the environment. Most of the SPRAY.SEED applied to a green plant is rapidly absorbed into the plant tissue over a period of a few minutes. Chemical not absorbed and remaining on the plant surface when exposed to light is broken down by the light into simpler by-products which have a low oral toxicity.

SPRAY.SEED absorbed into the plant under conditions of very low light intensity or darkness will move to a considerable extent through the plant, which explains why better results can be observed in more southern areas and during the winter months, or when spraying is done later in the afternoon or night. The bipyridyl herbicides must have light to work in the plant, and the higher the light intensity, the more rapid the action. Hence
the appearance of visible effects within a short period of time after spraying when applied on a bright sunny day. In the plant in the presence of light, the bipyridyls interrupt the photosynthesis pathway, which is the process by which plants manufacture their requirements for growth from the simple nutrients they take up from the soil through their root system. As a result of this interruption, the production of hydrogen peroxide occurs within the plant, and this explains the rapid yellowing or bleaching of the chlorophyll or green pigment. Without chlorophyll the plant dies, unless as is the case with some perennial species, it has the capacity through subsurface reserves to send up new growth.

SPRAY.SEED applied to the soil is completely inactivated, that is, it is totally unavailable either to plants growing in that soil or those which may germinate following spraying. This explains its non-residual action and why it can be used with safety prior to sowing crops. Most soils have sufficient capacity in the top 2 - 3 cm alone to absorb very many times the normal rates of application. The action of light can effectively degrade SPRAY.SEED from soil particles in the same way that it causes breakdown to simpler by-products on a leaf surface. But it has also been found that several fungal and bacterial species in soils are capable of decomposing bipyridyls, not only in solution but from the actual absorption on the clay particles.

One in particular, Lypomyces starkeyi, a yeast, has been shown to decompose bipyridyls very rapidly and completely, using them as a nitrogen or food source. It is this microbial action which explains the slow but continuous fall off in the level of SPRAY.SEED in the soil following application.
Farm Water Supplies - Are They Taken For Granted?

Ask yourself the following questions: -

Do you have adequate on-farm water supplies?

Is water a limiting factor? (stock numbers).

Have you investigated costs associated with water supplies and looked at possible alternatives?

What does scheme water cost you per annum?

Do you know what a roaded catchment is, how it works and costs involved?

A roaded catchment is a series of surveyed roads, which are formed up in a V-shaped cross-section, with the aim of increasing water run-off.

The Department of Agriculture provides a service free of charge to supervise construction of roaded catchments. This service includes, checking for a suitable catchment site, surveying roads, advice regarding size of catchment required and an estimate of approximate costs involved. Supervision of construction and checking of levels on completed catchment, is also part of the service provided.

Main Factors To Consider

1. Site
   
   Type and suitability of clay and proximity of site to the dam.

2. Overburden

   Depth of overburden effects width of roads to be constructed (Deeper overburden - higher the cost) Up to 0.6 m overburden acceptable.

3. Grader Operator

   His efficiency effects the the type of catchment constructed and the efficiency of that catchment. Cost of construction is directly related to efficiency of operator.
4. **Clay Cover**

Desirable to obtain even overall cover of road surface (8 - 15 cms).

5. **Compaction**

Of clay surface, by some form of rolling. 4 Tonne steel vibrating roller is most suitable.

6. **Fencing and Maintenance**

Catchment should be fenced off to stop stock damage. Keep free of weeds. Touch up surface with grader as needed.

Assessing catchment size in relation to Dam volume:

Rough rule of thumb is, 0.405 ha roaded catchment to 765 M3 of storage (1 acre/1000 yd3).

Allowances can be made for natural catchment, volume of Dam, type of clay catchment will be constructed in and stock to be watered.

**DAMCAT:**

This is a computer model, put together by J. Frith and R. Nulsen (Dept. of Agriculture research officers). Graphs obtained from this model provide us with the least cost combination of roaded catchment and Dam volume to water 1000 head of sheep on a drought proof basis, for a given area.

Inflow of the model is based on the daily rainfall figures for a given area, in relation to roaded catchment size and threshold. Outflow is stock consumption and evaporation for 1000 dry sheep with an average liveweight of 45 kg.

**NORTHAM:** Based on daily rainfall records Jan. 1907 to April 1975.

<table>
<thead>
<tr>
<th>Sheep Drink (Litres/Day)</th>
<th>Evaporation (cm)</th>
</tr>
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<tbody>
<tr>
<td>J</td>
<td>2.81</td>
</tr>
<tr>
<td>F</td>
<td>2.78</td>
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<tr>
<td>M</td>
<td>2.44</td>
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<tr>
<td>A</td>
<td>1.78</td>
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<tr>
<td>M</td>
<td>0.64</td>
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<tr>
<td>J</td>
<td>0</td>
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<td>J</td>
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<td>2.20</td>
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<td>2.65</td>
</tr>
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</table>

80
Using damcat, a 2000 m\(^3\) Dam with 1.5 ha of roaded catchment (8 mm threshold) would have provided a drought proof supply for 1000 sheep.

**COSTS**

In this area roaded catchments costs range between $250/ha and $500/ha.

Most catchments cost around the $350/ha mark. Going rate for hire of Cat. 12E grader for construction work is $30/hr.

Costs are determined by:

1. Soil conditions - dry, moist, wet.
2. Depth of overburden - cost increases with width.
3. Length of roads and gradient - ease to work, straight runs or curves.
5. Obstacles - encountered on site - rocks, roots, etc.

**Scheme Vs Dam and Roaded Catchment**

Using Damcat figures for Northam.

Cost of scheme water - first 16 k/litres @ 20¢/k/litre, over 16 k/litres @ 40¢ a k/litre (current charges).

Assuming first 16 k/litres is utilised for domestic, garden etc purposes, costs of scheme has been calculated at 40¢/k/litre rate.

Cost to Water 1000 sheep:

\[
\begin{align*}
2000 \text{ M}^3 \text{ Dam @ 60¢ M}^3 & = \$1200.00 \\
1.5 \text{ ha of roaded catchment at $350/ha} & = \$525.00 \\
\text{TOTAL COST} & = \$1725.00 \\
\text{Scheme - 492.7 k/litres @ 40¢ k/litre} & = \$195.00 \\
& \text{per annum}
\end{align*}
\]

Paying for scheme water, it would take 8.8 years to cover cost of Dam and roaded catchment.

If Dam already in existence it would take 2.7 years to cover cost of roaded catchment.

Plan ahead. Check out comparative costs for any future development of water supplies. Aim at drought proofing. Consider the long term cost of scheme water and possible future charges and reliability.
What is Soil Acidity?

Acidity is measured as pH, which is a measure of the level of hydrogen ion activity in the soil. The more hydrogen ions the more acid in the soil. pH is measured on a scale of 1-14 which is actually the negative logarithm (to the base 10) of the hydrogen ion concentration. A pH of 7 is neutral, pH levels above this indicate alkaline conditions and pH levels below 7 indicate acid conditions. The lower the figure the more acid the soil is.

Most of the light soils in Western Australia are on the acid side. However, cereals and clover grow quite well in mildly acid conditions. When acidity becomes more marked problems can develop adversely affecting plant growth.

There are large areas (estimated at about 600,000 hectares) of light soils, particularly in the north-eastern and eastern wheatbelt, where virgin pH levels are below 5.5 and often below 5. Most of these soils are the so called Wodgil soils and have long been recognised as problem soils. On these soils clover establishment and persistence is poor and crop yields are generally low. In soils in general, the build up in soil organic matter (associated with the use of phosphate fertilisers on improved clover pastures), which is beneficial in terms of nitrogen build up and increased cation exchange capacity, which improves nutrient relationships and moisture holding capacity, also contributes to increasing soil acidity.

Harmful Effects Of Soil Acidity

The main harmful effect of soil acidity on crop growth and yields are the effects on plant nutrition. The solubilities and availability of most nutrients varies with soil pH (Figure 1). In very acid conditions the availability of molybdenum is very low and therefore molybdenum deficiency could be a problem in these soils. On the other hand the solubility of aluminium and manganese increases with increasing acidity so that these elements can reach levels which are toxic to plant growth. It is likely that aluminium toxicity could be one of the major causes of poor yields on the acid soils. Aluminium begins to solubilise at pH 5.5 and this increases rapidly below pH 5. Aluminium toxicity causes severe root damage and interferes with phosphorus nutrition of the plant.
In acid soils the levels of the exchangeable bases calcium, magnesium and potassium are often low as these nutrients are displaced from exchange sites in the soil and lost. Calcium is applied in superphosphate and therefore should not generally cause a problem. However, it is possible that deficiencies of potassium and magnesium could arise.

With subclover, apart from the nutritional problems outlined above, there is a further problem in that the rhizobia, the bacteria associated with nodulation and nitrogen fixation by the legumes, do not persist in these soils from year to year. This means that in the years following planting, the subclover is not nodulated and cannot fix nitrogen. This results in pale yellow nitrogen deficient plant and consequently the clover disappears from the pasture.

Another important point is that although the topsoil may have a pH of 5.5 or above, the subsoil pH could be considerably less and toxic levels of aluminium could occur in the subsoil which could affect plant growth even when the topsoil appears satisfactory.

The Need For Nitrogen

Nitrogen is a very important nutrient for plant growth and therefore must be supplied in relatively high amounts by the soil or by the addition of inorganic fertilisers. Therefore, even though the nitrogen processes in the soil may contribute towards acidity they are essential for plant growth and yield.

Much of the nitrogen for crop growth in Western Australia is supplied by residues in the soil from previous legume based pastures. The legumes fix atmospheric nitrogen and increase levels of soil nitrogen. In fact, in most soils 95% or more of the total nitrogen in the soil is in the organic form. However, growing crop plants cannot utilise nitrogen in organic forms and must have access to the inorganic forms ammonium nitrogen (NH₄⁺) and nitrate nitrogen (NO₃⁻). Both of these forms can be taken in by cereals but in fact the majority of nitrogen uptake by the plants is in the nitrate form. The organic matter eventually breaks down (mineralisation) and the organic compounds, such as proteins, are broken down via amino acids etc. to eventually produce ammonium nitrogen. This process of mineralisation, which depends on micro-organisms, is also adversely affected by low soil pH. In most soils the ammonium nitrogen in a process known as nitrification. This process of course, also occurs with fertiliser ammonium nitrogen. Again this process is adversely affected by low soil pH.
Effect of Nitrogen Fertilizers on Soil pH

All nitrogen fertilizers which contain or produce ammonium nitrogen tend to lower the pH of the soil (increase acidity). This is because of the nitrification process mentioned above. When ammonium nitrogen is converted to nitrate, hydrogen ions are produced. The soil acidity is increased due to the production of the hydrogen ions.

If some of the nitrogen is taken up by the plant as ammonium the nitrification cannot be carried out on this portion and the acidifying effect will be reduced. Similarly, if there are atmospheric losses of ammonia (e.g. from urea) the effect will be reduced in the soil. All commonly available sources of nitrogen fertiliser are potentially acid forming. The most acid forming sources are sulphate of ammonia, M.A.P. and D.A.P., and therefore the Agras fertilisers also, because they are based on sulphate or ammonia and ammonium phosphate. Because half of the nitrogen in ammonium nitrate (Agran 34-0) is already in the nitrate form then the acidifying effect of this source is less. Urea produces ammonium nitrogen during its breakdown and conversion to nitrate but the initial soil reaction is alkaline. The long term effect of urea is to acidify the soil but to a lesser extent than sulphate of amonia. The relative acidifying power of these sources is shown in Table 1.

Physiological acidity can make some contribution to lowering soil pH. An example of this would be the application of ammonium sulphate to a crop. This fertiliser in solution consists of positively charged ammonium ions (NH4+) and negative charged sulphate ions (SO4-). If the ammonium ions are taken up by the plant at a faster rate than the sulphate ions then the plant will excrete hydrogen ions to maintain electrical nutrality. The reverse can also occur with other salts.

Results To Date

Positive responses to lime have been observed on acid soils at Kirwan, Wilroy, Miling, Merredin Research Station, Kalannie and a number of other sites on Wodgil soils. More recently CSBP obtained a wheat yield increase from the use of 1 tonne/ha ground limestone.

In continuous cropping trials at Merredin and Wongan Hills Research Stations the use of 376 kg sulphate of ammonia reduced the soil pH from 5.4 to 4.5 at Merredin and 5.8 to 4.8 at Wongan Hills over the 12 years the trials were carried out. This treatment resulted in reduced yields which were attributed to aluminium toxicity (Mason and Toms 1975, Mason 1980).
Figure 2 shows that at Wongan Hills, where yields tended to decline over the 12 years of the trial, the fall was greater where sulphate of ammonia was used at the high rate (76 kg/ha actual nitrogran) than where urea, at the same rate of nitrogen, was used.

Current Work

The trial programme to investigate aspects of soil acidity is being stepped up considerably. Almost certainly lime will have to be used to raise the soil pH to overcome the problem. Work needs to be done to sort out the necessary rates, times, methods and frequency of application of lime on different soils.

Another aspect under investigation is the possibility of using acid tolerant pasture species and/or strains of rhizobium for subclover.

At present we do not know how long it will take for pH levels to drop to a point where growth and yields will be adversely affected. This will depend on a number of factors including soil type, initial pH level, rates and frequency of application and source of nitrogen fertiliser and cropping rotation.

Sandier or lighter soils are likely to be affected more quickly than heavier soils because of the lower "buffering capacity" of the light soils. The buffering capacity of a soil is its capacity to resist the change in pH and is directly related to clay and organic matter content.

The amount of lime required to bring the pH up to an acceptable level will also depend on soil type. To lift the pH of soil by one unit much more lime will be needed on a heavier soil than on a light one when both soils were at the same pH initially. This again is related to the greater buffering capacity of the heavier soil.

The optimum rate of life for each situation will have to be determined. It would probably only be necessary to lime to a pH above 5.5 initially and perhaps add regular small amounts or periodical larger amounts of lime to maintain this pH and neutralise the effects of the nitrogen fertilisers. Hopefully, in some cases relatively low rates of lime will be sufficient to eliminate problems.

Some caution will need to be exercised in liming. Over-liming to produce a high pH in soil could lead to problems of availability of other nutrients, notably trace elements other than molybdenum.
References


TABLE 1

Acidifying Effects of Commonly Used Nitrogen Fertilisers
Expressed In Terms of kg Calcium Carbonate (Ground Limestone)

Required to Neutralise The Acidity

<table>
<thead>
<tr>
<th>Fertiliser</th>
<th>Acidifying Effect/100 kg actual fertiliser</th>
<th>Acidifying Effect/100 kg actual nitrogen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urea</td>
<td>72</td>
<td>157</td>
</tr>
<tr>
<td>Sulphate of Ammonia</td>
<td>98</td>
<td>467</td>
</tr>
<tr>
<td>Ammonium Nitrate (Agran 34)</td>
<td>53</td>
<td>157</td>
</tr>
<tr>
<td>Agras No. 1</td>
<td>84</td>
<td>467*</td>
</tr>
<tr>
<td>Agras No. 2</td>
<td>56</td>
<td>467*</td>
</tr>
<tr>
<td>M.A.P.</td>
<td>56</td>
<td>467</td>
</tr>
<tr>
<td>D.A.P.</td>
<td>84</td>
<td>467</td>
</tr>
</tbody>
</table>

* Estimated
FIGURE 2

Reduction In Yield With Continuous Cropping Using Sulphate of Ammonia or Urea At 76 kg/ha/YR

(Wongan Hills Research Station)
INTRODUCTION

In 1974 farmers in the south-west of Western Australia reported that there were about 167,000 ha of previously croppable land which was no longer productive because of salt encroachment (Stoneman and Malcolm 1976). This represented just over 1 per cent of the total land cleared for agriculture.

It is estimated that since 1955 the rate of salt encroachment has been about 5000 ha per annum (Lightfoot et al. (1964), so that in 1980 it would be reasonable to assume that 200,000 ha of land are now affected by secondary salinisation. At $200 per ha, the value of land annually removed from production by salt is about $1 million.

In the last few years some wheatbelt farmers have been showing interest in the adoption of the Whittington interceptor bank system for salinity control. It is claimed that the bulldozer built banks intercept and hold surface and shallow sub-surface water flow and hence prevent valley waterlogging which, according to the promoters, is the chief cause of salt build-up.

Because of widespread publicity being given to the interceptor system, studies conducted by the Department of Agriculture have been undertaken on a farm at Dangin. A part catchment treated with banks is being compared with an adjacent area managed according to the recommendations of the Department of Agriculture.

EXPERIMENTAL METHOD

Research began early in 1978 when a grid of piezometers penetrating the deeper groundwater body and observation wells to 1 m depth were installed across the two treatment areas. Water levels and water samples for chloride ion (Cl⁻) determinations have been taken once a month. Interceptor banks were constructed in June 1979. Soil salinity measurements using the Wenner 4-electrode resistivity technique have been carried out annually.

Treatments on the Department of Agriculture area included installation of grade banks to control soil erosion and help prevent flooding of the saline flats. The cost of this treatment, plus fencing off the saltland was $350. A roughly equal area was treated with interceptor banks at a cost of $810. Puccinellia, a salt tolerant perennial grass was sown on the Department of Agriculture area at a rate of 4 kg/ha with super being applied at 110 kg/ha. Urea was applied at 80 kg/ha on the previously established Puccinellia.
RESULTS

Soils

Results from drilling delineated a thick layer of sandy kaolinitic clay, known as the pallid zone, extending from 1 to 15 m below the ground surface. Salt concentration profiles showed that this zone stored a considerable amount of salt, even beneath non-saline slopes. For example, at a non-saline site the total salt storage was found to be 66 tonnes NaCl (common salt)/hectare, with 84 per cent of this amount occurring between 4 and 8 m below the ground surface. The pallid zone clays were underlain by a zone of weathered rock up to 15 m thick. Measurements show that this zone is more permeable to groundwater flow than the clays above. Granite rock forms an impermeable basement.

Watertables

Regularly monthly observations of water levels in the piezometers showed that depth to water in the tubes fluctuated with time. Graphs showing water level fluctuations for wells to different depths in the landscape were compared to aid understanding of how water moves through the landscape.

Results from shallow wells on the slope showed that a temporary perched watertable developed after significant falls of rain in winter and spring, particularly in areas with greater depths of surface sand overlying clay. The perched watertables persisted for periods ranging from three weeks to four months. Salt contents were low and varied between 100 and 550 mg/L Cl⁻. It was noted that 50 per cent of shallow wells never showed watertable development.

Saturated hydraulic conductivity measurements were taken to determine permeability values for sandy soils (sandseams). Calculations showed that the shallow perched water on typical low gradient wheatbelt slopes would travel no more than 2 m downslope in 100 days.

Deeper bores on the slopes also showed a response to rainfall events, indicating that recharge to the deeper groundwater body does occur by water finding pathways to infiltrate down through the pallid zone clays to the weathered rock aquifer.

On the saline valley floor there exists a permanent shallow watertable, usually less than 1.5 m below the ground surface, with Cl⁻ contents ranging from 5 000 to 10 000 mg/L. Results from deep piezometers on the saline flats showed that the deeper groundwater in these areas is under considerable hydrostatic pressure, with equilibrium water levels ranging from close to the ground surface to up to 3 m above the ground surface.
Figure 1 is a graph showing monthly changes in the resultant groundwater pressure for a mildly saline site located between two interceptor banks. The water pressure was calculated from measurements taken from a group of piezometers to various depths. The graph shows that for most of the year the pressure is positive and hence is driving water up through the soil. A negative pressure means that water would be infiltrating downwards in the soil.

HISTORICAL EVIDENCE

The old "Dorakin well", located on the experimental site, was excavated to about 30 m depth in 1870. Before 1915 the water was suitable for human consumption and watering horses, suggesting a salinity value of around 1 500 mg/L Cl\(^-\). Today the salt content is 5 500 mg/L Cl\(^-\). In 1920 the well was reported to be half full of water (i.e. around 15 m below ground level). By 1950 the water level was observed to be similar to the present level, i.e. 0.3 m above ground level.

Assuming the surrounding land was cleared about the same time the well was excavated, then it took 50 years for groundwater in the valley to respond to this hydrological change. In the following 30 year period there was a 15 m increase in pressure of the deep groundwater with a four-fold increase in salinity.

ROLE OF INTERCEPTOR BANKS

Groundwater trends in both shallow and deep piezometers located near interceptor banks showed similar characteristics to piezometers located outside the influence zone of interceptors. Interceptors have had no significant effect on watertable levels to date.

Assuming the banks effectively intercepted all of the surface and shallow sub-surface flow moving downslope, hydrogeological investigations show that there is a year round input of water and salt to the saline flats. This comes from a large volume of deep groundwater which, although semi-confined by highly impermeable clays, is driven upwards by pressure through tiny remnant channel structures in the clay.

It has been argued that the pressure water has no hydraulic connection with the shallow watertable because of impermeable clays and cemented layers (hard pans) occurring between the two water bodies. Evidence from pits excavated with a backhoe on the saltland showed that old root channels and interpedal voids were leaking saline water through cemented clays on the bottom of the pits. Figure 1 shows that the greatest groundwater pressure occurs in late summer. During the very hot and dry summer of 1979-80, shallow watertables rose by up to 30 cm in response to this increasing pressure. Interceptor banks cannot reduce this pressure, and whilst they will reduce waterlogging on the saline flats they are not deep enough to lower the saline watertable significantly.
REFERENCES


CONTROL OF BROME GRASS USING SPRAY TOP

GOOMALLING

Effect of Spray Top - Rates x Time

No of Brome Grass Plants Emerging after opening rains

No of Brome Grass Plants x 100

NIL

425 mls/ha SPRAY SEED

850 mls/ha SPRAY SEED **

1700 mls/ha SPRAY SEED

Date of Application

T.1 21/9

T.2 5/10

T.3 20/10

** Recommended Spray Top rate.
CONTROL OF BROME GRASS WITH SPRAY TOP

BADGINGARRA

EFFECT OF SPRAY TOP - RATE X TIME

No of Brome Grass Plants emerging after opening rains.

Key
- 425 mls/ha SPRAY SEED
- - 850 mls/ha SPRAY SEED
- --- 1700 mls/ha SPRAY SEED

Date of Application

T.1 2/10
T.2 16/10
T.3 31/10

No. of Brome Grass Plants x 100

4 2 0

10 8 6 4 2 0

12 Nil

100
THE EFFECT OF SPRAYS ON THE ENVIRONMENT

W. WOODS

Introduction

The effect of pesticides on the environment is an emotive issue - and like most emotive issues, opinion is often polarized. On one side of the fence you hear comments like:

"Ban all pesticides"
"Pesticides are destroying the environment"

These comments, can be compared to those from the other side, such as:

"Pesticides are the only answer to pest problems"
"The more pesticides we use, the better".

In this paper I hope to steer what I consider is the middle road between these two contrasting extremes. This is not an easy task; the problem is a complex one. Thousands of papers and books have been written on this subject, and I have only been able to get information from some of them; enough I hope to present a picture of the truth, and to illustrate the difficulties people working in this field experience in the face of many, often conflicting, reports.

On the Shelf

Before they can be sold, pesticides must be passed as safe by Commonwealth and State authorities. The containers in which they are marketed, must be labelled correctly, with information on methods of use, withholding period, safety precautions and measures required to prevent contamination of the environment. Once registered for use, this use may still be restricted to certain crops or times of the year e.g. restrictions on the use of DDT in pastures or on mature barley crops.

In 1977 the cost to develop a new pesticide was estimated at 20 million dollars; much of this cost incurs in carrying out the extensive research and development work needed to satisfy stringent registration requirements. To recoup these costs, such a pesticide must be marketable worldwide and particularly on the U.S. market. It must fulfill the safety requirements of the respective environmental authorities including the extremely strict regulations administered by the E.P.A. (Environmental Protection Agency) in America.
Pesticides vary in direct toxicity to man. Some if accidentally swallowed, or spilt on the skin can kill; others cause only minor side effects. This direct toxicity is usually expressed as an LD50; the lower the LD50 the more toxic a pesticide, the higher the LD50 the less toxic. The LD50 is the amount of pesticide given to a group of animals (usually rats) that will kill 50% of them. LD stands for lethal dose, and this does is expressed as milligrams of pesticide per kilogram of body weight. From the table it can be seen that in general insecticides are much more toxic than herbicides.

### LD50's for some pesticides

<table>
<thead>
<tr>
<th>Herbicide or Insecticide</th>
<th>Chemical Name</th>
<th>Example of Trade Name</th>
<th>LD50 (mg/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Phorate</td>
<td>Thimet</td>
<td>4</td>
</tr>
<tr>
<td>I</td>
<td>Parathion</td>
<td>Folidol</td>
<td>13</td>
</tr>
<tr>
<td>I</td>
<td>Dieldrin</td>
<td>Dieldrin</td>
<td>46</td>
</tr>
<tr>
<td>I</td>
<td>Omethoate</td>
<td>Lemat</td>
<td>50</td>
</tr>
<tr>
<td>I</td>
<td>Dimeton-s-Methyl</td>
<td>Metasystox</td>
<td>57</td>
</tr>
<tr>
<td>I</td>
<td>Propoxur</td>
<td>Baygon</td>
<td>90</td>
</tr>
<tr>
<td>I</td>
<td>DDT</td>
<td>Pespruf</td>
<td>113</td>
</tr>
<tr>
<td>H</td>
<td>Paraquat</td>
<td>Gramoxone</td>
<td>150</td>
</tr>
<tr>
<td>H</td>
<td>Bromoxynil</td>
<td>Brominil</td>
<td>190</td>
</tr>
<tr>
<td>I</td>
<td>Chlorpyrifos</td>
<td>Lorsban</td>
<td>163</td>
</tr>
<tr>
<td>I</td>
<td>Phosmet</td>
<td>Imidan</td>
<td>230</td>
</tr>
<tr>
<td>H</td>
<td>Diquat</td>
<td>Reglone</td>
<td>230</td>
</tr>
<tr>
<td>H</td>
<td>2,4,D</td>
<td>2,4,D</td>
<td>370</td>
</tr>
<tr>
<td>I</td>
<td>Dimethoate</td>
<td>Rogor</td>
<td>500</td>
</tr>
<tr>
<td>H</td>
<td>2,4,5,T</td>
<td>2,4,5,T</td>
<td>500</td>
</tr>
<tr>
<td>I</td>
<td>Trichlorfon</td>
<td>Dipterex</td>
<td>630</td>
</tr>
<tr>
<td>H</td>
<td>M.C.P.A.</td>
<td>M.C.P.A.</td>
<td>700</td>
</tr>
<tr>
<td>I</td>
<td>Carbaryl</td>
<td>Bugmaster</td>
<td>850</td>
</tr>
<tr>
<td>H</td>
<td>Amitrole</td>
<td>Amitrole</td>
<td>1100</td>
</tr>
<tr>
<td>H</td>
<td>Permethrin</td>
<td>Ambush</td>
<td>1300</td>
</tr>
<tr>
<td>H</td>
<td>Triallate</td>
<td>Avadex</td>
<td>1670</td>
</tr>
<tr>
<td>I</td>
<td>Malidison</td>
<td>Malathion</td>
<td>2800</td>
</tr>
<tr>
<td>H</td>
<td>Dicamba</td>
<td>Bonex</td>
<td>2900</td>
</tr>
<tr>
<td>H</td>
<td>Atrazine</td>
<td>Atradex</td>
<td>3000</td>
</tr>
<tr>
<td>H</td>
<td>Diuron</td>
<td>Diuron</td>
<td>3400</td>
</tr>
<tr>
<td>H</td>
<td>Linuron</td>
<td>Linuron</td>
<td>4000</td>
</tr>
<tr>
<td>H</td>
<td>Simazine</td>
<td>Simazine</td>
<td>5000</td>
</tr>
<tr>
<td>H</td>
<td>Bromacil</td>
<td>Bromacil</td>
<td>5200</td>
</tr>
<tr>
<td>H</td>
<td>Picloram</td>
<td>Tordon</td>
<td>8200</td>
</tr>
<tr>
<td>H</td>
<td>Trifluralin</td>
<td>Treflan</td>
<td>10000</td>
</tr>
</tbody>
</table>
On The Crop

It is important to realise that after a pesticide is applied, the amount remaining in the environment does not remain constant. Various factors act to break the pesticide; this is why chemicals will only kill pests for a limited time after application. The most important factors influencing the persistence of pesticides are:

1. Type of pesticide - organochlorine insecticides (e.g. DDT) are more persistent than organophosphates (e.g. malathion or synthetic pyrethroids (e.g. permethrin).

2. Soil type - pesticide is absorbed into clay particles and organic matter in soils, thereby increasing the persistence but decreasing its activity.

3. Soil moisture - in wet soils less pesticide is absorbed onto soil particles; it is therefore subject to loss by evaporation, or attack by micro-organisms.

4. Soil temperature - the processes by which pesticides are lost from the soil - chemical degradation, microbiological decomposition, evaporation - work faster at higher temperatures.

5. Soil micro-organisms - bacteria and fungi degrade pesticides, often forming harmless by products. Soils differ in the type and number of micro-organisms.

6. Sunlight - U.V. light breaks down pesticides; therefore pesticides in general break down faster on the soil surface than when cultivated into soil.

All these factors combined may give a pesticide persistence in the soil from a few days to many years.

In Western Australian Agriculture, the most used pesticides are herbicides, followed by insecticides and then fungicides. The total amount of pesticide used is an important determinant of pollution potential. In Western Australia around 500 tonnes of pesticides are used annually. This can be compared with the 600 000 tonnes of pesticide produced in the United States in 1975.

Herbicides

Residues

In general it can be said that residues of herbicides used in agriculture do not build up from one year to the next, since at the dosages used on croplands, very few persist in the soil for more than a year. Average times for the disappearance of 50% and 90% of some herbicides are:
Effect of Herbicides on Soil Animals

(a) DIRECT EFFECTS - only certain herbicides are directly toxic to insects and soil animals. For example simazine kills springtails; 2,4,D is toxic to ground beetles and ladybirds; monuron kills earthworms. It appears that most herbicides are not directly toxic to most soil creatures. For example, 2,4,D although killing ground beetles, does not kill springtails or earthworms. Toxicity of herbicides to bees can vary from being toxic (2,4,5,T), to slightly toxic (2,4,D) to quite toxic (paraquat).

(b) INDIRECT EFFECTS - Herbicides can change the number and species of plants in a crop or pasture; effecting food and shelter of various creatures. If herbicides severely reduce vegetative ground cover then numbers of soil animals will decrease; if they cause a change in composition with broad leaved weeds replacing the grasses, then numbers may increase. Herbicides can cause indirect losses to bees due to loss of nectar bearing plants.

Effect of Herbicides on Soil Micro-Organisms

"Compounds applied to the soil as selective herbicides have caused either no change in total micro-organism flora, or a reduction that proved transitory. With 2,4,D and amines or esters applied at the practical dosages between 0.25 and 4 lb/acre, a total of 27 investigations found that they had no effect on the total number of micro-organisms or on their activity "(Brown 1978). With some herbicides such as 2,4,D the micro-organisms become adapted to break down the herbicide and populations of these organisms increase in the soil; in some soils in Canada where 2,4,D has been applied for 25 years, the time taken to degrade 2,4,D has reduced from 80 days to 14 days over the years because of such an adaption.

Effect of Herbicides on Man

As a group, herbicides have a low toxicity to man when compared with insecticides. Recently, concern has been aired over the use of 2,4,5-T which contains the highly toxic dioxin TCDD. In experiments female rats treated with 245T containing 30 ppm of the dioxin TCDD has shown a 20 - 50% frequency of malformations in their offspring.

Changes in the production practices now ensure that the dioxin level of 2,4,5,T does not exceed 0.1 ppm; this level is considered to be safe to humans. Monitoring of 2,4,5T sold in Australia shows levels of 0.01 - 0.03 ppm.

---

<table>
<thead>
<tr>
<th></th>
<th>50%</th>
<th>90%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simazine</td>
<td>105 days</td>
<td>360 days</td>
</tr>
<tr>
<td>Linuron</td>
<td>24 days</td>
<td>169 days</td>
</tr>
<tr>
<td>2.4.D</td>
<td>17 days</td>
<td>26 days</td>
</tr>
</tbody>
</table>

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Insecticides

Persistence

It is well known that organochlorine insecticides such as DDT will remain in the environment for a long time. As they are fat soluble, they are stored in the fat of animals, fish and birds. These insecticides residues have been shown to reduce the numbers of some animals; predatory birds are particularly vulnerable, as DDT and its metabolites can cause a thinning of egg shells with consequent chick mortality.

However, in most animals, the low levels of DDT detected have not been shown to cause harmful effects.

In contrast to the organochlorine insecticides, the organophosphate and synthetic pyrethroid insecticides break down rapidly in the environment and their residues are not a problem. Consequently there has been a world wide trend against the use of organochlorines and towards the use of these newer compounds.

A comparison between one of the first organochlorine insecticides (DDT - discovered 1939) and a newer synthetic pyrethroid insecticide (permethrin - discovered 1973) will highlight the reasons behind the shift away from organochlorines. While both are general broad spectrum insecticides the structure of permethrin is based on that of the natural pyrethrin insecticides extracts from chrysanthemum flowers. Table 3 shows their differences:

<table>
<thead>
<tr>
<th></th>
<th>DDT</th>
<th>PERMETHRIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synthesis</td>
<td>One step</td>
<td>Many steps</td>
</tr>
<tr>
<td>Cost</td>
<td>$7/kg active ingredient</td>
<td>$188/kg active ingredient</td>
</tr>
<tr>
<td>Activity</td>
<td>300g ai/ha</td>
<td>30g ai/ha</td>
</tr>
<tr>
<td>Solubility</td>
<td>low</td>
<td>low</td>
</tr>
<tr>
<td>Water</td>
<td>high</td>
<td>high</td>
</tr>
<tr>
<td>Persistence in Soil</td>
<td>low for years</td>
<td>months</td>
</tr>
<tr>
<td>Animals</td>
<td>stored in fat</td>
<td>readily metabolized and excreted</td>
</tr>
<tr>
<td>Toxicity to:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) rats</td>
<td>LD50 - 113</td>
<td>LD50 - 1300</td>
</tr>
<tr>
<td>(b) birds</td>
<td>metabolites low</td>
<td>low</td>
</tr>
<tr>
<td>(c) fish</td>
<td>medium</td>
<td>high</td>
</tr>
<tr>
<td>(d) beneficial insects</td>
<td>high</td>
<td>high</td>
</tr>
<tr>
<td>(e) earthworms</td>
<td>low</td>
<td>low</td>
</tr>
</tbody>
</table>
Important points to note about synthetic pyrethroids are:

(1) they are readily degraded by light and micro-organisms in the field and by metabolic processes in animals.

(2) lower rates of insecticide are needed with consequently less undesirable side effects.

(3) they have a low toxicity to man.

(4) they cost more than other insecticides.

Important points to note about DDT are:

(1) DDT degrades slowly.

(2) As DDT is soluble in fatty substances it is stored in fatty tissues of birds, fish and man.

(3) There is no evidence that DDT in fat causes injury to man's health. DDT intakes hundred of times greater than those encountered by the general population have been tolerated by volunteers for more than a year and by factory works for as long as DDT factories have existed. "Over 150 persons with heavy prolonged occupational exposure to DDT have been subject to exhaustive medical examinations, but the only relevant findings were those that could be predicted i.e. increased storage and excretion of DDT and its metabolites and a mild stimulation of the microsomal enzymes of the liver" (FAO 1972).

(4) Lifetime feeding experiments on a tumor prone strain of laboratory mice showed that DDT increased the incidence of liver cell tumors.

(5) Various studies have failed to show that DDT causes cancer in Man; feeding DDT to men for 2 years did not result in tumours and no tumours were found in men whose occupation was the manufacture, formulation or application of DDT.

Effect of Insecticides on Other Insects

(a) Many pests are kept below damaging levels by their natural enemies; if a pesticide is applied these natural enemies may be killed. For example DDT applied to kill webworm also kills the predators of the lucern flea. As lucerne flea's are relatively unaffected by the spray their numbers explode. To lessen such effects, where possible selective insecticides, killing pests but not harming beneficial insects, are used. The combination of these insecticides, biological control, resistant plant varieties and selected cultural practices is known as Integrated Control or Pest Management. It is in this direction that insect control is heading in the future.
(b) Many insecticides are toxic to bees if directly applied. However, certain insecticides, can be applied to flowering crops, when bees are not foraging. e.g. at night, and the residue remaining the following day will not harm the bees.

Effect of Insecticides on Soil Animals

Persistent insecticides can cause a reduction in the numbers of soil animals; the effect is not usually drastic with a 50% decrease in numbers being rare. However, it seems the predatory animals, such as mites, are more likely to be killed than plant feeders such as springtails. DDT does not kill earthworms and is not very toxic to the larger soil animals. The situation is summarised by Edwards 1973 "There is still no evidence that the effects of persistent pesticides on soil invertebrate populations influence soil fertility".

Effect of Insecticides on Soil Micro-Organisms

Most of the evidence is that "although microbial activity may be disturbed by excessively large residues or organochlorine insecticides, the effects of the amounts likely to occur in practice are insufficient to cause any significant decrease in soil fertility "Edwards 1973. Effects are generally short lived and microbial populations soon recover.

Fungicides

The main use of fungicides on wheat and sheep farms is cereal seed treatment for protection against smuts and bunts. At the highest rate of application recommended - 200 mls of fungicide/100 kg of seed, only 100 mls of fungicide would be used on a hectare of crop. As this is a seed treatment, there is little scope for contamination of the environment.

Conclusion

Pesticides are poisons; their use requires acceptance of a certain risk to man, and his environment. However, this risk; if pesticides are used correctly; is small. I feel the following quote from Mellanby 1977 puts the problem into its true perspective:-

"Man must therefore learn to live with pesticides. He can cut down their use, for instance, by accepting a small amount of damage to his crops, many of which may be over-protected for cosmetic reasons. He can encourage research to find safer and less toxic pesticides, and to find acceptable non-chemical methods of control. But he must accept the fact that he is using toxic substances to kill living organisms, and that some harm may occur to man himself and to the environment."
However, we must keep a sense of proportion. The world today is a dangerous and unstable place. Ecological damage from many other more dangerous pollutants is feared, with some reason, by many. We know that our unrenewable resources are being exhausted and we have no guarantee that satisfactory alternatives will be available in time. But these dangers pale into insignificance beside the political dangers which face us today. With the proliferation of nuclear weapons, the chances of evil men to secure supplies of plutonium which may destroy our civilisation, and even human life on earth, are vastly increased. Compared with these possible - even probable - catastrophes the dangers from pesticides are surely not such as to keep us awake at night".
References


Gilbey D Herbicides; with special reference to selected herbicides used in the high rainfall areas of Western Australia - Proceedings: Seminar on the use of herbicides and pesticides in forestry and agriculture. Bunbury 30th June, 1980.


World Health Organizaton 1972 Health hazards of the human environment.
It is quite clear that through much of the wheatbelt there has been a dramatic slow down in the rate of pasture sowing in the last 10 years. This followed a period of dramatic growth from 1950 when there were 1.5 million hectares of improved pasture to 1970 when 7 million hectares had been established. The current figure is 7.5 million hectares and much of this area is established pasture in name alone. What are the reasons for this sequence of events and what can we expect for the future?

The lack of new pasture establishment can be partly attributed to the poor economic conditions prevailing in the early 1970's. In addition compound fertilizers provided a convenient and moderately cheap source of inorganic nitrogen for crops. In recent times the run of poor seasons has had a considerable impact on the ability to invest in such things as pasture establishment and sheep numbers have tended to decline as a result of poor seasonal conditions and the heavier cropping regimes introduced to most of the area as a result of good grain prices. All these factors have combined to bring about a general lack of interest in pastures through much of the 1970's and the poor seasonal conditions and heavier cropping have resulted in less and less clover being seen in existing pastures. On many farms the much talked about clover ley farming system really does not currently exist.

What then can we expect for the future? Are we heading for a cereal monoculture or a system where a few sheep are run on odd paddocks of volunteer pasture and cereal stubbles. I believe that we are currently at a turning point and the trend will be towards the re-establishment of existing pastures and new pasture establishment for sound economic reasons.

REASONS FOR LEGUMINOUS PASTURES

1. NITROGEN

The high and increasing cost of nitrogen fertilizers is the dominant factor which will encourage increased emphasis on improved legume pastures. On most of our wheatbelt soils substantial amounts of Nitrogen fertilizer would be required if continuous cropping were to be undertaken (of the order of 40 - 50 kg N/ha). This would in most cases reduce the profitability of such a system below the level of a system of crops grown without nitrogen plus sheep run on leguminous pastures in a relatively intensive cropping rotation.
2. **INCOME STABILITY**

Even if cropping continuously were more profitable, farmers using the system would face the significant risk of "putting all their eggs in one basket". A downward movement in prices would place a farm business organized in such a way under severe economic pressure and the system allows very little flexibility to make changes to cope with such a system.

A cereal sheep system has considerable flexibility to cope with relative changes in the prices of commodities, both inputs and prices.

In addition a mixed system has more flexibility to cope with bad seasons. Sheep can be sold or agisted if the season is bad or if the start to the season is bad less area can be planted to crop which will have a lower yield potential anyway. The sheep can then be run on a larger area and sheep income maintained. In addition stubbles of failed crops tend to be higher quality and hence their utilization by sheep is better than in good seasons.

3. **UNDER UTILIZED RESOURCES**

On most farms sheep can be run by the permanent labour force without employing additional staff except for contract jobs such as shearing. Where permanent staff is necessary, then the rotation farming system spreads the work load more evenly throughout the year. In addition an increased emphasis on cereals usually means that there is much wasted cereal stubbles unutilized.

4. **DISEASES**

In areas where "take-all" is a problem, the rotation of cereals with a legume dominant pasture allows a "cleaning phase". If continuous cropping were attempted under such conditions it is likely that yields would fall off rapidly due to the "take-all".

5. **LONG TERM SOIL EFFECTS**

The effect of legume pastures is to improve soil structure by increasing soil organic matter. This results in increased soil stability in relation to water and wind erosion. Moisture holding capacity and moisture availability to the plant is also improved by improved soil structure.

A continuous or intensive cropping regime without leguminous pastures will have effect of degrading soil structure. As a result yields will be lower in the long run even with the addition of nitrogenous fertilizers.

The situation on heavy land is less obvious but long term continuous cropping will result in reduced soil structure leading to such problems as surface sealing and increased erodability.
PASTURES IN AN INTENSIVE CROPPING SYSTEM

If you accept the case for leguminous pastures in an intensive cropping system then can pastures survive in such a system? Can the trends of the past 10 years be reversed and if so how can this be achieved?

I believe that with improved management effort which is justified by the returns from the pasture phase, heavily legume dominant pastures can be grown in most wheatbelt areas. The increased emphasis will be on growing a clover or medic dominant pasture because the better and denser the pasture the more nitrogen will be fixed for subsequent exploitation by crops.

WHAT VARIETIES TO GROW

In the intensive cropping system the selection of the variety that will produce the most seed with a high quantity of hard seed is of the utmost importance.

In the case of heavy land situations Cyprus barrel medic has been extremely successful and has continued to regenerate after crops even following a poor run of seasons. It is quite likely that superior varieties will come from current introduction and assessment programmes but until then Cyprus fits well into a system of intensive cropping.

Concentration on persistence has been the main aim of the wheatbelt clover breeding and selection programme which has resulted in the recent release of the variety NUNGARIN and NORTHAM. Nungarin, compared to the variety Geraldton, which is replaces, has a high seed production and a good increase in the proportion of hard seed. For the drier wheatbelt areas this variety is the logical choice for light land pasture establishment and re-establishment.

In the high rainfall areas of the wheatbelt, the currently recommended variety is Northam. In some areas best results may well be obtained by a mixture of varieties such as a mixture of Northam and Nungarin in this area around Cunderdin. On the very west of the wheat growing areas Daliak is the likely best variety. In general the trend is towards varieties with a higher hard seed content to fit in with increased cropping intensity.
ESTABLISHMENT & RE-ESTABLISHMENT TECHNIQUES

A number of options are open with regard to establishment and re-establishment techniques. It is an area in which there is little conclusive research work available, especially recent work with current varieties, but the two main options are to sow into a cereal stubble or to undersow with a cereal crop.

a) CONVENTIONAL ESTABLISHMENT - Conventionally clover has been established by sowing 8 - 10 kg/ha of seed into stubble at a depth of 1 - 2 cms at or near the break of the season using inoculated and lime pelleted seed. This is a successful technique with depth of seeding being of vital importance. However, it is an expensive technique at today's seed price ($2.00/kilogram).

In some cases the seed is sown through a small seeds box and at other times mixed with the fertilizer.

Another variation is to topdress the seed and fertilizer and then bury the seed with harrows. This technique is somewhat less effective because the seed and fertilizer are not banded and the seeding depth is inexact.

b) The second method widely used is undersowing. This involves the sowing of a lower rate of seed usually 1 - 3 kg/ha with a cereal crop. The crop and clover grow together and there is hopefully sufficient seed set to produce an acceptable stand of clover in the year following the crop. The advantage of the system is the lower cost for seed (1 - 3 kg vs 8 - 10 kg for conventional sowing), but the crop yield can be expected to be lower as a result of competition from the clover.

Again the clover can be sown through a small seeds box or sown by mixing with the fertilizer. If sown as a mixture the combined seeding should be shallower than normal to ensure an adequate clover emergence.

One of the serious problems with undersowing is post emergent weed control. It is generally better to undersow in a second crop where weed control in the first crop has been good. If spraying is necessary it seems clear that certain current herbicides have some selectivity. It seems likely that an adequate selective herbicide will be available to kill most broad leaf weeds but have limited activity on clover or medic.

Results from undersowing are likely to be relatively more successful in the future with the advent of earlier maturing varieties which compete less for moisture and the possibility to sow undersown crops early and control weeds later using herbicides.
PASTURE MAINTENANCE

In an intensive cropping system the difficulty arises in maintaining adequate levels of pasture in the long term. Apart from the benefit arising from new varieties, it will probably require a combination of management practices in order to maintain the pasture. Some possible strategies relate to grazing practices, weed control in pasture phase and choice of rotations.

1) GRAZING - In the critical establishment year the pasture will usually benefit from light grazing in the winter and early spring but little or no grazing in the flower setting phase.

2) SPRAYING - The establishment of clover on new land is a relatively easy exercise because weed populations are generally low and the new pastures face little competition from other species. Pasture establishment and re-establishment on older land is more difficult because with increased fertility, heavy competition can be expected from volunteer species. The use of herbicides to selectively control both broad leaf weeds and grasses in clover pastures is under investigation and this strategy is likely to have the combined effect of creating a clover dominant pasture which will provide an increased amount of seed and at the same time reduce the population of weed seeds going through into the following cropping phase.

3) The choice of rotation is likely to have a considerable impact on pastures. Although it is accepted that frequent cropping is likely to be economically essential, a number of rotational options are still open.

As an example strong arguments can be put forward for a 2:2 rotation rather than a 1:1, but still giving the same overall cropping intensity. However, the system would almost certainly need a "top up" of clover probably undersown in the second crop. The system would allow extra flexibility in crop and pasture management because all the crop would not be first year pasture and sheep can for instance be concentrated on the second year pasture during the spring to control weeds prior to cropping.

SUMMARY

It seems likely that pastures will play a more important part in our farming systems in the 1980's than they did in the 1970's. However, they will be grown in a more intensive cropping system which will lead to the requirement for extra management input to maintain such pasture in a state of legume dominance.
SIROSEEDING - A TECHNIQUE FOR DIRECT DRILLING

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SUMMARY

The conditions under which a seed bed is to be prepared in a direct drill situation are discussed in terms of the ground surface, vegetative cover, stubble, soil mixture, soil structure and moisture. Siroseeding is then described as a technique for creating the seed bed. A brief description of the ground engaging tools used is given and how they perform under the varying conditions earlier described.

1. INTRODUCTION

"It is not ploughing, it is not digging, it is not harrowing, raking, howing, rolling, scarifying, clod-crushing, scuffling, grubbing, ridging, casting, gathering that we want: all these are time honoured, time bothered means to a certain result. That result is - a seed bed."

Wren Hoskyns, 1845.

While farming systems vary all over the world, from one part of a country to another, and even from one farm to the next - the requirement of seed bed is common, somewhere for the planted seed to germinate readily, push its roots into the soil, and freely emerge, free of competition for sunlight and moisture.

In recent years in Australia and overseas, methods of farming that require virtually no tillage or, as commonly terms in Australia, Direct Drilling, have emerged. There are many reasons for this trend. The availability of a wide range of pre and post emergent herbicides have been largely responsible for making the system possible. The impetus to develop this technique of farming has been given by the potential to; greatly reduce soil erosion; reduce man hours in ground preparation, allowing time for other farming occupations especially on wheat/sheep farms; reduce fuel costs, improve soil structure; reduce capital outlay in machinery; give more flexibility and control of sowing dates; and in the long term improve profitability.
2. DEFINING THE VARIABLES

Creating a seed bed in previously undisturbed ground in one pass is an entirely different situation from preparing a seed bed over a period of time with a number of different machines. The ground surface is likely to be uneven, vegetative cover may or may not be present and previous crop residue may or may not be present. These variables along with the soil texture and structure, as well as the moisture regime, determine the conditions under which the seed bed is to be created.

Ground Surface

In preparing a conventional seed bed, usually a relatively flat surface is achieved before the final sowing. This condition does not occur in Direct Drilled areas. If the paddock was in pasture prior to sowing then unevenness is caused from tussocks of soil and animal foot prints. If the paddock was cropped the previous season (and allowing that stock may not have been on the grounds), there are still undulations from header tracks and possible spray cart tracks. If conditions were wet when either of these operations were carried out these tracks can be very marked.

Vegetative Cover

The vegetative cover present at sowing is dependant on the pasture species, the rainfall during the previous season, and the amount of grazing.

Perennial grasses such as philaris form a thicker sod than say annual rye grasses. Naturally heavy thick sods are more difficult to plant into than less matted more friable sods.

Stocking the area to be sown will reduce the vegetative cover considerably. In fact, in some areas of Australia where Direct Drilling is being successfully commercially employed, this stocking aspect is one of the key factors in managing the system. In a sense, the farmer/grazier is using his sheep to replace his plough.

Although not strictly vegetative cover, but nevertheless a related variable, is the grip the roots of the vegetation have on the soil. A term "root release" has recently emerged from those working in the field. Experience has shown that roots bind together a large amount of soil making seed bed preparation difficult. After the herbicide is applied and the vegetation begins to die, the roots lose their grip on the soil and the tilth becomes more friable. In this respect, the time and type of herbicide usage is important.
Stubble

The amount of stubble present at sowing time varies from very little where grazing has taken place to volumes that make machinery manufacturers shudder. Where stubble retention is practiced, it is largely done to reduce soil erosion though there may also be some reduction in evaporation. However, the presence of straw does not greatly affect the seed bed except in the physical obstruction it makes to the machinery being used. If there are extreme amounts of straw the emerging plant could suffer from loss of exposure to sunlight. From the viewpoint of the seed bed the straw should not be mixed with any soil around the seed and secondly, surface straw should not impede the growth of the crop.

Texture, Structure and Soil Moisture

As with conventional systems of seed bed preparation, lighter textured friable soils are more manageable than heavy clays which tend to stick and smear when they are over wet or alternatively become blocky and susceptible to crusting when they are drying.

Soil structure is a subject that is receiving a fair deal of attention at the moment on a number of fronts.

The era of the 150 hp plus tractor has seen greater loads applied to the soil surface than before as well as greater speeds of operation. Fortunately, with Direct Drilling, there is little opportunity for destroying the soil structure through over handling the soil, and studies are also being carried out examining soil structure under Direct Drill systems. However, in spite of the gains Direct Drilling may have given to the soil structure, experience has shown that seeding equipment needs to have greater ability to penetrate to sowing depth.

Naturally, soil moisture is of prime importance in a successful seed bed and without sufficient moisture the plant may not emerge and establish or even germinate. It is unlikely that there is any significant difference between the moisture required in a conventional seed bed to that of a Direct Drilled seed bed. Dr. J. Baker from Massy University in New Zealand has suggested that if broken sod and trash can shield the seed bed then moisture loss through evaporation can be minimized.
3. **SIROSEEDING - THE TECHNIQUE**

Siroseeding is a technique of creating seed bed rows in a single pass of a set of ground engaging tools. On the Siroseeder, these rows are 25 cm apart, which is wider than the traditional 7" (18 cm). The wider row spacing is to allow sod and trash from the row area to be placed between the rows. Having removed the top layer of sod, the exposed soil is cultivated into a fine tilth and the seed is placed in this tilth about 1 to 2 cm above the bottom of the bed. Soil free from sod or trash is then returned to cover the seed and pressed down.

4. **SIROSEEDING - THE HARDWARE**

In working sequence each row consists of a coulter, depth wheel, tyne applicator with fitted mouldboards, and press wheel.

**Coulter**

The coulter is approximately 430 cm in diameter and the coulter assembly is clamped to the mainframe, the coulter casters allowing the machine to be turned in the ground as well as giving some degree of protection against obstacles. However, a shear pin protects the coulter against large stones and stumps.

The function of the coulter is to cut either the sod or trash directly in front of the tyne applicator. In the case of sod, this allows the sod to neatly pass either side of the tyne rather than cursting out in irregular shaped clods. In straw conditions the coulter minimizes the amount of straw that builds up in front of the tyne which can cause blockages.

The coulter is generally set to a depth below the ground of 5 to 7 cm.

**Depth Wheel**

Each row has its own depth wheel which is attached to a spring release beam assembly. The depth wheel is the zero pressure type 100 cm wide and about 28 cm in diameter. This gives every row a predetermined constant sowing depth even over undulating or uneven ground. The necessity to maintain a constant sowing depth is probably more important with Direct Drilling. This is because there is less suitable soil to cover the seed. Should the seed be planted slightly shallow there may be hardly any suitable soil to cover it.
Applicator Tyne and Mouldboards

The applicator tyne that the Siroseeder is based on comes from a John Deere sod seeding implement. To this applicator the CSIRO has fitted miniature mouldboards which invert sod from the row area and place it in the inter row. Approximately 12 cm of surface material is removed from above the row and placed in the inter row space. This means that the inter row space is generally completely covered. The width of the slot that is cultivated is much narrower, about 6 cm at the top, taping down to 2 or 3 cm. This soil is cultivated by the tyne into a microseed bed and the seed placed in this tilled soil about 2 to 3 cm from the bottom of the slot. When the seed germinates, the roots can grow into the soft tilled soil surrounding it.

Provision is also made that the fertilizer is applied down a separate tube so that it falls to the bottom of the slot.

The amount of tilt "to" and "aft" on the machine alters the "throw" of the mouldboards. With the heel of the mouldboard down low, more sod is thrown that if it were raised. In the raised position, an entirely different effect may be achieved, the sod is not removed from the seed bed area. It is cut and slightly raised. This condition will restrict the emerging plant and is not generally favoured. However, if the crop is of a vigorous nature, some moisture benefits can be gained from this setting as the sod prevents evaporation.

To the back of the mouldboard, two small harrows can be fitted that deflect soil from edges of the slot back onto the seeded area.

Press Wheels

A specially shaped zero pressure press wheel, 10 cm wide and 40 cm in diameter, follows behind the applicator. A soft rib 25 cm deep by 25 cm wide at the top and 35 cm at the base, presses into the slot to consolidate the soil above the seed. The firm edges of the press wheel press down inverted sod, thus helping to keep the slot free from sod. Lastly, the leading press wheels (the tyne applicators and press wheels are staggered "fore" and "aft") act as shields preventing sod from being thrown from the mouldboards of the rear tynes into the adjacent rows.

5. SIROSEEDING - UNDER VARYING CONDITIONS

As mentioned earlier, the conditions under which Direct Drilling are carried out vary considerably.
Sod Conditions

Providing adequate grazing has been carried out (vegetation no longer than about 5 to 7 cm) and an effective herbicide treatment has been achieved, Siroseeding is a suitable technique in establishing a new crop in that pasture. Many different crops have been successfully established ranging from cereals to improved pastures.

Stubble Conditions

Under medium to light straw conditions the Siroseeder will establish very even rows of seedlings. The trash will be removed from the row area forming a mulch of soil and trash on the inter row space. This leaves a very geometric corrugated effect on furrows and hollows. During light falls, precipitation concentrates in the hollows and there may be some benefit from the effect. Under heavy rain, these furrows could be a disadvantage if they run downhill making an erosion hazard. The corrugation effect can be largely minimized by drawing light harrows behind the machine.

Burnt Conditions

If the straw is burnt off so that there is little ground cover at all, then conditions are relatively easy for Direct Drilling. The mouldboards on the applicator can be removed under these conditions to give less disturbance of the soil.

CONCLUSION

Siroseeding offers a precise technique for establishing most crops under Direct Drill situation. A sod-trash free micro-seedbed is created giving cultivated soil for the roots of the germinating seed to readily penetrate. Sod and/or trash have been removed from the row area allowing obstruction free emergence of the seedling.

It is the creating of this controlled seed bed environment that characterizes Siroseeding as a technique for Direct Drilling.
INTRODUCTION

Pesticide usage is an integral part of the farming system and will remain so as long as insect pests, fungal diseases and weeds continue to cause financial losses by reduced production. Industry today uses the pesticides market as a valuable source of income. Throughout the world, some six thousand million dollars will be spent in 1980 on pesticides; of this amount herbicides will take about 43% (i.e. $2,641m). This expenditure is projected to increase by some 13% by 1984 to nearly $3,000m.

The Western Australian farming industry is also a large user of pesticides. Estimated figures suggest as much as 2.5m hectares of crop was sprayed with herbicides in 1979 at a cost of $1.21m for chemicals alone. This is a considerable investment and it is essential that to obtain the maximum response, the application of these herbicides should be as accurate as possible. For instance, consider what would happen if there was a 10% error in spraying. This means the chemicals were applied at 10% above the recommended dose; this could cost the farming industry some $120,000. This is only the tip of the iceberg, because it is the extreme that cause the big losses. If a crop is treated with too low a dose of chemical then the weeds are not killed and continued competition from them ultimately decreases the crop yield, and hence the monetary returns. Conversely, if the crop is overdosed, although the weeds are naturally killed, in many cases the crop will be affected causing loss of yield.

If farmers are purchasing costly spray equipment and chemicals, it is surely to their advantage to ensure that the correct rate of application is applied and that the machines are operated so that the best results can be obtained. Failure of herbicides treatments are invariably blamed on conditions at the time of spraying, but more often than not the technique of applying the chemicals is the major factor. A quote from a recent publication just about sums up the situation, "Manufacturers of spray equipment would often be horrified if they saw what was done with their machines. The call for greater speed and lower volumes can cause problems. The resultant wild gyrations of the boom dashing up the paddock, looking like a metal monster trying to take to the air". 
In a very general way this paper looks at some of the sprayers and spraying techniques, and some of the developments that will eventually be used on commercial boom sprays.

BOOMSPRAY DESIGN

Agitation

Most boom sprays today have satisfactory agitation. This is essential particularly where powders or flowable powders are being used. The agitation is necessary to keep the fine particles of powder in suspension. Sprayers having inadequate facilities for the required agitation should be fitted with pumps delivering a greater capacity or where the wheel driven type of machines are used, a P.T.O. pump should be added. The major problem with the wheel driven pumps, such as those fitted to the computer spray, is that while filling the tank and making any repairs in the paddock, the tank mixture cannot be agitated. Therefore while the sprayer is not moving some of the spray material may settle to the bottom of the tank.

Height of Spraying

With conventional fan nozzles it is advisable to adjust the height of the boom so that the fan from each nozzle overlaps to the centre of the fan of the adjoining nozzles. (Fig.1).

It is quite obvious what will happen if the height is incorrect. Overdosing and unsprayed strips will occur if the boom is too low to the ground.

Uneven application will also occur if the boom is too high. Most of the wider booms have wheels attached near the end of the arms so that the correct height is maintained. On many small booms no such allowance is made and the violent dipping of the arms may cause striping when spraying in rough or rocky paddocks.

FIG.1

CORRECT HEIGHT OF BOOM TO ALLOW DOUBLE OVERLAP

OF NOZZLE FANS.
Spray Hoses

Main lines to the cabin should be strong and able to withstand flexing. Many low pressure hoses flatten out or kink at supporting points, hence restricting the flow of spray.

Taps on the End of Booms

Where powders or flowables are used, taps at the end of the boom arms allow flushing out to be done to remove any of the powder deposits in the lines.

Nozzle Angles

Because of the overlapping of the spray fans of each nozzle it is necessary to angle the nozzles slightly to prevent the fans running into each other (Fig. 2).

FIG. 2

ANGLING OF NOZZLES TO PREVENT SPRAY FANS RUNNING INTO EACH OTHER

On large booms where the section of the tank is not in line with the arms, it is of some benefit to angle the nozzles on each arm so the fans are facing the driver, thus improving visibility (Fig. 3).

FIG. 3

ANGLING OF NOZZLES ON EACH ARM OF THE BOOM SO THAT THEY FACE THE OPERATOR
This permits the driver to look into the fans on both arms and easily detect any blocked nozzles.

Possible Innovations to Commercial Sprays

Mixing chemicals has always been a problem both because of the measuring and the safety aspects. Some units have already been fitted with devices that draw off the undiluted chemical from the original container and correctly meter it into the spray lines. Additional benefits of this is the removal of tank agitation, cleaning out tanks, and never having the problems of a spray tank with a mix half used while repairs are made or waiting for weather conditions to improve before recommencing spraying.

With the advances in electronics, some booms in the USA and Canada have monitoring systems which keep the operator informed on the output of each individual nozzle and the ground speed. Instead of having the chemical lines connected to taps within the cabin (which may be a health risk if one should burst, particularly if using some of the more toxic compounds), all the controls are connected to solonoid valves on the unit.

Better shock absorbing devices are desirable to prevent the movement in all three planes (rolling, pitching and yawing), which accounts for a lot of variation in the rate of application of chemicals over short distances, and may explain why one weed is killed yet an adjacent one is not.

Reduced chemical applications may be possible by better understanding of the interaction of droplet size on various species of plants. Spraying only the target weed and not wasting material on bare ground is also being studied. Other developments include the use of electrostatically charged droplets which are only attracted to the target weeds.

More efficient methods of marking the swathe are needed to prevent both overlapping and missed stripes.

It is inevitable that in the future there will be a trend towards lower volumes of application. This will have the benefit of reducing the time wasted in filling tanks, and allow greater areas to be treated. However, there may be additional problems. Firstly, there is still considerable research needed to determine whether herbicide performances will be altered due to the different droplet spectrum produced. There is a chance that there will be a narrowing of the tolerance between crop and weed. The biggest problem is going to be in the area of calibration. At higher volume
(100 L ha⁻¹) it is possible to be about five litres per hectare out in application without causing any significant damage. However, when dealing with volumes of 15-20 L ha⁻¹, a five litre error above the recommended rate could cause serious crop damage. This then leads us to the following section which deals with the most important aspect of spraying i.e. calibration.

**Calibration**

This is the area which seems to give most trouble to operators. Perhaps this is because it appears complicated, or because the correct measuring equipment is not used. The problem is that many different techniques for calibration are used which mostly involve tedious measurements or mathematical calculations. I am illustrating in this paper a simplified method of calibrating which applied to boomsprays having nozzles spaced at 50 cm. It can be used for other spacings, but a conversion factor is necessary, or another chart for the particular nozzle spacings is required.

No matter what technique of calibration is used the preparation is the same.

1. Firstly clean all filters and nozzles and flush clean water through the system.

2. Check all nozzles for output. This is done by setting the pressure at that normally used for spraying (30 psi or 200 kPa). Measure accurately the amount of liquid discharged from each nozzle in one minute and record the volume. For this step an accurate measuring cylinder is absolutely essential. Rough measurements at this step will result in poor calibration and probably poor spraying results. A good measuring cylinder which is graduated in intervals of 10ml can be purchased from firms dealing in scientific equipment. Any nozzle that varies greatly from the majority of the volumes recorded should be replaced. A general rule is that nozzles varying by + of the volume of the average should be discarded. Most manufacturers work to this tolerance.

This output test should be repeated regularly, particularly when using powders because their abrasive nature tends to wear most nozzles. A boomspray I recently calibrated had been used for one season to spray a powdered herbicide and gave individual nozzle outputs varying from 690 ml through to 1100 ml in one minute of test. When new nozzles were fitted the outputs only varied from 650 - 680 ml per minutes, so you can see considerable wear had taken place.
It will be of value to record each nozzle and the volume of water discharged in a one minute test, because during the spraying season you can randomly select half a dozen or so nozzles and re-check their output. If they are still fairly close to the original test then no adjustments are necessary. However, if the volumes have changed more than 5%, checks should be made for nozzle wear or any pressure setting changes that might have occurred on the pump.

A simplified method of calibration is illustrated in the attached Departmental Farmnore. This quick method firstly allows you to select the speed at which you want to spray. This will be determined by the nature of the paddock. Once the speed is selected it is just a matter of fixing the throttle or noting the engine speed and the gear in which you will be travelling. From there the output of the nozzles should be checked at the engine speed at which the spraying will be done. The average output of a nozzle can be determined and from the chart the output of the boom determined.

**HINTS FOR MIXING CHEMICALS**

1. Never add the chemical, especially powders, into an empty tank. The tank should be 1/2 - 3/4 filled with water before the chemical is added. Booms with P.T.O. or motorized pumps should have the agitators running when the chemical is added.

2. Powders should be pre-mixed in a bucket. A thin slurry should be obtained which contains no lumps before it is added to the tank.

3. Protective clothing should be worn. Gloves and respirators are advisable particularly when pouring chemicals into the tank and there is a risk of inhaling vapours.

4. Chemicals spilt onto the skin should be immediately washed off. Hands and face should be washed before touching food or smoking. Clothes worn during spraying should be washed separately.

5. Never pour by lifting containers above head level as spillage may contact the face or eyes, etc.

Always have a container of clean water at hand for use when required.
Conserving fodder whether as hay or silage is a costly process. The crop or pasture has to be grown, cut, raked, wrapped up in some kind of package and perhaps carted to a storage place and then carted out again before feeding. Machinery and labour are involved in almost every part of the system. In 1975 Adviser Ted Rowley surveyed fodder conservation systems throughout the Esperance district.

At the 100 tonnes a year level hay cost from $32 to $62 a tonne to make depending on the system of fodder conservation used. At the 400 tonnes a year level the cost ranged from $16 to $20 a tonne and at the 800 tonnes a year level from $12 to $20 a tonnes. All for a product that has a sale value of $35 to $80 a tonne and then only if it is in small square bales.

The table below gives additional details on hay making costs.

**FODDER CONSERVATION COSTS (ESPERANCE) (1975)**

Includes mower conditioner, raking, baling, storing and feeding out.

<table>
<thead>
<tr>
<th>METHOD</th>
<th>Cost per Tonne</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>100+ A Year</td>
</tr>
<tr>
<td>Traditional baling (S.P.)</td>
<td>62.16</td>
</tr>
<tr>
<td>Traditional baling (P.T.O.)</td>
<td>41.92</td>
</tr>
<tr>
<td>1 tonne stack-wagon</td>
<td>45.80</td>
</tr>
<tr>
<td>3 tonne stack-wagon</td>
<td>60.13</td>
</tr>
<tr>
<td>5 tonne stack and mover</td>
<td>60.60</td>
</tr>
<tr>
<td>114 kg fodder rolls</td>
<td>32.30</td>
</tr>
<tr>
<td>450 - 680 kg fodder rolls</td>
<td>42.80</td>
</tr>
<tr>
<td>450 kg large square bale</td>
<td>43.29</td>
</tr>
</tbody>
</table>
At least two conclusions can be drawn from the table. One is that the fodder rolls, large and small and large square bales are cheaper methods of packaging hay than other methods of packaging hay. The other conclusion is that the more hay you make the cheaper it is to make. However, the more you make the more land, labour and capital you have tied up in fodder conservation that could be used for something else - growing grain, fattening stock or whatever.

Growing grain and storing it on the farm is itself a form of fodder conservation. Fattening stock during spring so that they reach condition score 4 or 5 by the end of spring is also a very effective form of fodder conservation. It is highly efficient in terms of dietary energy and it is cheaper than making hay. Thus, the fat an animal puts on in spring represents a store of energy that can be utilised along with paddock feed during the summer/autumn period.

Hay Quality

One of the problems with hay is that most hay is only 50 to 55% digestible. Which means that it only contains enough energy to maintain mature stock. When feeding this kind of hay, stock must also have grain or pasture if the farmer wants the stock to grow.

Hay of 45% digestibility can be compared with dry grassy pasture in feed value. Stock will lose condition if this is their only food.

Hay of 60% digestibility or greater when fed freely to stock will enable them to grow slowly even if they don't have any grain or green pasture.

Producing Good Quality Hay

Hay making does not improve the quality of the fodder being conserved. Nor does silage making. Indeed hay making reduces the fodder's quality through mechanical damage to the fodder and through rain falling on the crop after it has been cut or on the bales lying in the paddock.

Raking and baling hay when it is so dry it is brittle leads to a large loss of leaves, the most nutritious part of the plant. Fodder rollers tend to be more gentle with hay than the conventional baler.

Rain on nearly dry hay washes out the soluble carbohydrates thus reducing the digestibility. Protein levels are less affected by rain.

So the farmer needs to treat the crop gently - avoid raking and baling in the middle of a hot day and to roll it up or put it into the shed before it rains. Don't delay!

The farmer also needs to make hay out of good quality fodder.
Pasture Hay

Pasture hay with a high content of clover is usually high in digestibility and high in protein.

Pasture hay cut when the grasses and clovers are still in flower is usually higher in quality than hay cut at a later stage. But heavy rain falling on the early cut hay will lower its digestibility. Cutting early gives farmers a chance of producing good quality hay. Cutting late gives the farmer no chance of producing good quality hay.

Mature grassy hay with little leaf is poor quality hay - being low in digestibility and in protein. It's not very different from dry mature pasture.

Cereal Hay Quality

In 1975 Mr Harry Fisher conducted a series of trials on Mt. Barker, Avondale and Gibson Research Stations into cereal hay varieties. The varieties were compared on the basis of their production and their quality and measurements were taken at five different times during the spring. The following figures come from the Avondale trial.

**AVONDALE RESEARCH STATION 1975**

Trial sown June 9, 1975

<table>
<thead>
<tr>
<th></th>
<th>Percent Crude Protein</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>23/9/75</td>
</tr>
<tr>
<td>Long Season Oats</td>
<td></td>
</tr>
<tr>
<td>Swan/West</td>
<td>10.9</td>
</tr>
<tr>
<td></td>
<td>9.0</td>
</tr>
</tbody>
</table>

N.B. Long Season Oats concerned were Algerian, Blackbutt, Cassia, Coolabah and Saia.

<table>
<thead>
<tr>
<th></th>
<th>Percent Digestible Dry Matter</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>23/9/75</td>
</tr>
<tr>
<td>Long Season Oats</td>
<td></td>
</tr>
<tr>
<td>Swan/West</td>
<td>76</td>
</tr>
<tr>
<td></td>
<td>71</td>
</tr>
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</tbody>
</table>
Note the gradual drop in digestibility and protein content as the plant matures. Note also that on November 12 when the grain was in the dough stage and fairly close to the normal hay cutting stage, the quality of the crop was only 6.7 to 7.1% crude protein and 55% digestible. After a normal hay making operation the hay would be lower in quality than this because of the leaf losses and respiration losses that usually occur during hay making.

A hay quality survey conducted by the Bunbury Office during 1979 found that the average oaten hay in the Busselton, Bunbury, Harvey region was 52% digestible and 7.3% crude protein. Oaten hay containing some legumes was better than this, pure oaten hay was very poor in quality.

Indeed, cereal hay is usually of a low quality. However yields per hectare are high compared to pasture hay yields. One way to produce better quality cereal hay is to cut it early. But this will mean producing less hay per hectare.

**Legume/Cereal Mixtures**

Lupin/Cereal, Pea/Cereal, Vetch/Cereal combinations are another way to improve hay quality but they need more investigation in different environments. Field Pea/Cereal Hay trials are currently in progress (1980) in the Narrogin area and at Bullsbrook near Perth.

**Cereal Hay Yields**

The Harry Fisher series of trials and trials in other areas have shown that oats produce more hay than wheat and wheat produces more than barley.

However few cereal hay variety trials have been done so it is not really possible to say what variety of oats is best for cereal hay in a particular area. Trials really need doing in each district to determine the best varieties for hay. This kind of trial is not easy to do however. Farmers may find it well worthwhile carrying out their own investigations, perhaps in co-operation with a Department of Agriculture adviser.

**Long Season Varieties** e.g. Algerian, Saia, Baroota Wonder.

The Harry Fisher series of trials indicated that long season varieties tend to reach peak production at late milk early dough stage, about 25 to 30 days after flowering. Yield then drops probably because moisture becomes limiting. Long season varieties also remain vegetative longer and give highest dry matter yields at a given stage of development. They withstand prolonged and heavier grazing better than short season varieties. However, though they recover readily from grazing (for grain or hay production) grain quality is usually lower than that of short season varieties.
Most soils contain adequate nutrients on which to grow a crop. Unfortunately most of the nutrients are in forms that are unavailable to the crop, and so there is a need to supplement these by adding fertilisers.

The question is how much fertiliser?

Historically fertiliser rates have been determined by trial and error and by field experimentation from which certain rules of thumb have been derived (Cox curves). There was a time when this was adequate. However with the ever decreasing margin of profit, due to rapidly rising costs and less rapidly rising returns, this is no longer good enough.

This has led to the development of soil and plant tissue testing as a means of determining the available nutrients in the soil and so the necessary fertiliser to make up the shortfall.

The soil testing method involves treating soils with dilute solutions of acids and alkalis which simulate the ability of plants to take up specific nutrients. These tests are checked against yield results from fertiliser experiments in the field.

The interpretation of these chemical tests varies with the soil type, the type of crop and the climate as effected by rainfall and temperature.

Unless a soil test has been properly calibrated for the local conditions by relating soil test results to soil, crop and climate, the test is relatively useless.

This calibration has been done in the W.A. wheatbelt for soil phosphorous determined as the number of ppm of P extractable in a weak sodium bicarbonate solution (0.5 M Na HCO₃).

The first criteria in interpreting this test hinges on how reliable the initial soil sampling was. Does it truly represent the area to be fertilised?

To ensure that it does the sampling procedure must be meticulous.

1. Use a proper tool to get uniform sized core samples to 10 cm depth.
2. Bulk core samples from uniform representative areas of the paddock.
3. Avoid a-typical areas such as head lands and sheep camps.
4. Don't include surface litter, manure or fertiliser granules.
Now having got a truly representative sample analysed we can talk about what it all means by using "Decide" - the Decide Prediction Model.

Decide relates yield responses in field experiments to soil type and soil phosphorous levels. To the cost of super, the price of produce and to risk. To the future value of applied super and the time and method of application. The answer requires a fairly complicated mathematical calculation best done by computer or by means of a series of graphs or charts.

Because of the principal of diminishing returns it never pays to produce the maximum (i.e. 100%) maximum yield, but rather something less, depending on the cost price ration.

For wheat there is a relatively low cost to price ratio and it pays to produce at about 97.5% of maximum yield. This is achieved at a soil test level of 20 to 25 ppm on normal soils.

For grazing sheep there is a relatively high cost to price ratio (sheep are less economic) and it pays to produce at around 90% of maximum production. This is achieved at a soil test level of around 12 ppm. In other words you apply less super to your pasture than to crop, but in applying less super you can only carry a lesser number of sheep. If you wish to throw out economics and carry high stocking rates you have to apply more super.

Many farms have unnecessarily high soil test figures and could well apply no super.

Results from the 1979/80 series of soil tests carried out for farmers in the drought areas indicate that 20% of samples have over 25 ppm and so don't require super.

Two points emerge from these tables.

1. Above a certain soil test level it does not pay to use any super. This level is lower for the less economic livestock enterprise.

2. At moderate soil test levels the amount of super applied is not critical though generally it pays to aim high rather than low because of the principle of diminishing returns.

However an example of decide computer presentation gives a range of options showing what will be the likely outcome under varying seasonal conditions by varying from the optimum rate topdress v drilled application.
Soil test for phosphorous can also be used to trace the effect of your fertiliser policy over a number of years and indicate whether you are building up or depleting the soil. Generally you should aim at an economic level of production and maintain soil phosphorous levels at that required level.

Conclusion

Rule of thumb methods of fertiliser assessment are inaccurate and generally over estimate needs resulting in uneconomic levels of application. Soil testing for phosphorous is a means of putting precision into your fertiliser decisions as a necessary in the competitive farming situation that exists today.

Soil testing for Nitrogen as an accurate indication of fertiliser requirement, is just not on at present.

Relating soil nitrogen to crop yield appears to be a problem. This is because the nitrogen is stored mainly in the organic matter in the soil (plus the soil solution). This organic matter fraction of the soil is quite fragile and big changes can occur between sampling and utilisation by the crop.

Rainfall in the year of cropping has a very substantial effect on the response of the crop to nitrogen. Thus any recommendation must contain an element of rainfall prediction in it and as such be only approximate. That is Nitrogen recommendations at the best can only be made within a broad range.

Potassium is not a widely used fertiliser but may become more significant as levels of production rise. Cereal yield responses have been obtained in the wheatbelt and potassium is no doubt limiting crop and pasture production in some situations.

Potassium fertiliser in the wheatbelt situation for normal soils is generally uneconomic for crop and livestock production.

For the present situation it can be said that soils containing more than 70 ppm of potassium have little chance of an economic response to potassium fertiliser. Below this level responses can be expected in pasture with economic response below 20 ppm.

Copper and zinc soil tests (usually ammonium oxalate extraction) are used as a guide to identifying deficiencies. Because of the small amount of fertiliser required rate of application is not very important.

Plant tissue tests are another subject but provide scope for more accurate diagnosis of nutrient deficiency and provide a guide to rates of application required. They are most useful in the case of trace element recommendations.
Plant tissue tests do have the disadvantage of being known after the event and generally after any action can be taken. (exception possibly trace elements).
RELATIONSHIP BETWEEN SUPER HISTORY AND CURRENT REQUIREMENT FOR WHEATBELT CROPS

Current Super Requirement (lb/ac)

Super applied in past (lb/ac)
PRINCIPLE OF DIMINISHING RETURNS

Small increase here

Kg Wheat
or
$
income

Big increase here

50 kg super added

kg Super
### Optimum Super Rate for Cereals Normal Soils

<table>
<thead>
<tr>
<th>Price Ratio</th>
<th>Yield Level</th>
<th>Soil Virg</th>
<th>Test 2</th>
<th>PPM 5</th>
<th>Soil 8</th>
<th>Test 12</th>
<th>PPM 16</th>
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<td>110</td>
<td>70</td>
<td>20</td>
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<tr>
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<td>210</td>
<td>170</td>
<td>130</td>
<td>80</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.9</td>
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<td>220</td>
<td>180</td>
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<td>90</td>
<td>40</td>
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<tr>
<td>0.8</td>
<td>95.3</td>
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<td>230</td>
<td>190</td>
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<td>290</td>
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<td>0.3</td>
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<td>0.1</td>
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<td>400</td>
<td>360</td>
<td>320</td>
<td>270</td>
<td>220</td>
<td>160</td>
<td>100</td>
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</table>

**Value of Super Bank**

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>30</th>
<th>70</th>
<th>110</th>
<th>160</th>
<th>210</th>
<th>270</th>
<th>330</th>
<th>390</th>
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<tbody>
<tr>
<td><strong>Super History</strong></td>
<td>0</td>
<td>200</td>
<td>600</td>
<td>1000</td>
<td>1500</td>
<td>2000</td>
<td>2500</td>
<td></td>
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</tbody>
</table>
## DISTRIBUTION PHOSPHOROUS SOIL TEST PPM 1980

<table>
<thead>
<tr>
<th>SOIL TEST CATEGORY P.P.M.</th>
<th>NO OF SAMPLES</th>
<th>%</th>
<th>CUMULATIVE %</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 5</td>
<td>77</td>
<td>0.9</td>
<td>0.9</td>
</tr>
<tr>
<td>5 - 8</td>
<td>513</td>
<td>5.7</td>
<td>6.3</td>
</tr>
<tr>
<td>9 - 12</td>
<td>1281</td>
<td>14.2</td>
<td>20.7</td>
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<tr>
<td>13 - 16</td>
<td>1870</td>
<td>20.7</td>
<td>41.4</td>
</tr>
<tr>
<td>17 - 20</td>
<td>1882</td>
<td>20.8</td>
<td>62.3</td>
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<td>21 - 25</td>
<td>1789</td>
<td>19.8</td>
<td>82.1</td>
</tr>
<tr>
<td>26 - 30</td>
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<td>31 - 40</td>
<td>592</td>
<td>6.6</td>
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</tr>
<tr>
<td>40</td>
<td>109</td>
<td>1.2</td>
<td>100</td>
</tr>
</tbody>
</table>
Superbank

The only bank that charges you interest on the money you deposit.

<table>
<thead>
<tr>
<th>Now</th>
<th>Next year</th>
<th>the year after</th>
<th>and the next</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 kg</td>
<td>50 kg</td>
<td>33 kg</td>
<td>25 kg</td>
</tr>
<tr>
<td>20 kg</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$100 invested now

is worth $50 next year

in two years is worth $33

and in 5 years is only worth $20

Only in South America can they afford inflation like this.

Can you?
Today on Old Country we are working on the flat part of the response curve.

Here you can put on a lot of super without getting much effect.

Or

In other words

It doesn't make much difference how much super you put on.
INTRODUCTION

The main weather elements that affect plant growth are radiation, rain, temperature and humidity and there is an optimum climate for best growth and health of plants. Perhaps the most important of these weather elements is rain. The enormous amount of rainfall received over the agricultural districts from the weather systems can be gauged by the fact that 25 mm (the old inch) or rain gives just over 22,000 gallons of water on each acre.

FORECAST AND WARNING SERVICES

The Bureau's budget is about $40M, nearly half of this is devoted to the chain of events which leads to the preparation and dissemination of forecasts and warnings.

The South West division is divided into 10 districts. The Cunderdin area is located in the Central Agricultural district.

Forecasts are issued twice daily for this area, one in the morning at about 5 am and another in the evening at about 5 pm. An outlook for the following 24 hours is included and also the estimated maximum and minimum temperatures for the towns of Northam, Kellerberrin, Merredin and Southern Cross. These forecasts are broadcast over the media.

In addition, warnings are issued when hazardous conditions are likely to endanger crops, stock or people. The main warnings are:

(1) Fire Weather Warnings
(2) Sheep Weather Alerts
(3) Frost Forecast
(4) Gale or thunderstorms over land

PRESSURE SYSTEMS AND FRONTS

(a) Surface Observations

Besides the staff at the Bureau, there are also about 800 observing stations and 7000 rainfall stations scattered throughout Australia and the surrounding islands.

People that take observations are our own staff on aerodromes, Post Office clerks, lighthouse keepers, forestry officers and farmers. These people are part-time observers, i.e. they have their own job to do and get paid an allowance for taking weather observations. This is an incentive which is necessary because very few people would get out of a warm bed at 3 o'clock in the morning just to read the temperature. Ships also send in weather reports.
As soon as these observations are read they are sent by telex to the Bureau, and within an hour they are plotted on a chart so that we have a full network of the weather conditions throughout Australia, the surrounding islands and some observations from ships in the adjacent oceans. In addition satellite pictures are received at the Bureau every three hours.

(b) Upper Air Observations

Besides these surface observations, which are taken every three hours, stations on aerodromes put up a balloon every six hours, to which is attached a transmitter and other instruments for measuring temperature, pressure and moisture content of the air up to about 25 miles (100,000 ft) above the earth. With these observations we draw upper air charts which are used for forecasting for aircraft, such as the height to fly to obtain the least wind resistance, what height to avoid flying in continuous cloud and what height and what route should be taken to avoid turbulence.

These balloons expand as they ascent in less dense air and finally burst. They descend slowly by means of a small parachute.

(c) Lows, Troughs

When a weather map is analysed we find certain configurations, or patterns. On a sea-level chart we will find areas that have a lower pressure than the surrounding region. These are called low-pressure centres or areas, or simply lows for short. They are also called cyclones because the air flows around them in a cyclonic direction (clockwise in the Southern Hemisphere). Lows are usually characterized by inward and rising air motion which results in cooling and increased relative humidity. Sufficient lifting with adequate moisture will produce condensation of water vapour into clouds and may result in precipitation. Latent energy released by the condensation adds to the energy of the circulation system. A low pressure trough is simply an elongation of a low.

(d) High, Ridges

High-pressure cells are another type of pressure pattern observed on analysed weather maps. A high-pressure area is surrounded on all sides by lower pressure. We call it a High for short. It may also be referred to as anti-cyclone because the windflow around a High is anticyclonic (anti-clockwise in the Southern Hemisphere). The airflow in a High is generally outward and descending. For this reason, Highs are usually areas of minimum cloudiness and little or no precipitation. If the air descends from very high altitudes, it may be extremely dry. A high pressure ridge is simply an elongation of a high.
(e) **Fronts**

Air of different densities does not mix readily, thus when two different air masses meet a front is formed such that the lighter air is lifted by the heavier air. Fronts are the major cause of winter rains in the agricultural districts.

(f) **Pressure gradient and winds**

The strength of the wind depends on the pressure gradient. For example, if the pressure difference is 10 millibars between Geraldton and Albany, i.e. 6 isobars (lines of equal pressure), a fairly strong wind would be experienced in the Central Agricultural district.

To locate where the position of the pressure systems are in respect to a locality stand with your back to the wind and the low is to the right of the locality.

**RULES**

1. There is a 90% chance of rain in the Central Agricultural districts within 48 hours when the 9 am pressure is 1014 or less.

2. Frosts are likely when the pressure is 1030 millibars or more.

3. The long wave pattern is used to forecast the movement and intensity of cold fronts.

**CLIMATE (Cunderdin)**

Percentage probability of rainfall exceeding specified totals:

<table>
<thead>
<tr>
<th>Effective Rainfall</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>August</th>
<th>September</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 mm</td>
<td>73</td>
<td>95</td>
<td>99</td>
<td>89</td>
<td>22</td>
</tr>
<tr>
<td>50 mm</td>
<td>76</td>
<td>91</td>
<td>99</td>
<td>87</td>
<td>37</td>
</tr>
</tbody>
</table>

The average break of the season is about 1st May and the average length of the growing season is just over 4 months.

The average range in temperature, max. minus min., for February the hottest month is 16 degrees. The average range in temperature, max. min. 9 am, for February is about 9 degrees.
IS THE CLIMATE CHANGING?

One of the questions that has been asked since man inhabited this earth, is the climate changing? Are we heading for a new Ice Age? Is man's pollution etc leading to a warmer climate?

This, of course, cannot be answered at the present time. A great deal of research and a huge amount of data is required from pole to pole and in the upper air, in order to attempt to answer this question. This is one of the reasons why Australia has set up a network of weather stations in the Antarctic.

I would like to describe one small element that may change the climate through man's interference.

The amount of carbon dioxide in the air is less than one per cent of the total atmosphere.

During the last 20 years there has been an enormous increase in the use of energy. Most of this energy is obtained from fossil fuels, coal, oil, etc.

When fossil fuels are burnt the gas carbon dioxide is released. It is predicted that the amount of carbon dioxide in the air will double some time next century.

What is the effect of carbon dioxide? Although an invisible gas it has the capability of absorbing heat from the earth, i.e. it allows heat from the sun to pass through to the earth but heat from the earth is absorbed and thus the atmosphere is heated. At present most of the heat escapes through the atmosphere to space.

So an increase in carbon dioxide will warm the atmosphere and, of course, upset the rainfall pattern.

What is predicted to happen?

A mathematical model was designed to see what would happen. The results were:

(a) The temperature over Australia will rise about 2 to 3 degrees but the temperatures over the Antarctic will rise about 6 to 7 degrees.

(b) The rainfall in the north of Australia will increase whereas in southern Australia it will remain unchanged to decrease slightly. However, southward to the Antarctic the rainfall will decrease markedly.

(c) Thus the effect on wheat in Australia will be minimal.

(d) However, in the Northern Hemisphere where a large part of wheat is grown north of latitude 40°, the effect on wheat will be very marked.
(e) As I have said the biggest changes will occur at the Antarctic so you can see the necessity for gathering data in that region.

(f) Finally, the mathematical model is over-simplified and ignores many other possible influences. The best method by far is to continually monitor the atmosphere to try and pick up a trend.
Many listeners have lacked an accurate guide to the Official Meteorological Areas referred to in ABC weather forecasts.

We hope that these maps will fill the need. They come to you with the good wishes of the Australian Broadcasting Commission.
The inherent objective of feeding sheep for production is profit. Whether a particular production feeding programme will be profitable will depend on a multitude of factors, and decisions about those factors made by the producer. Some of these factors are listed below:

i) Production Measures
- growth rates achieved by sheep
- feed consumption levels
- effects of type of sheep fed
- effects of type of feed used
- rate of feeding
- proportion of roughage in the diet
- proportion of protein in the diet
- effect of processing feedstuffs (cracking, rolling, soaking of grain)
- formulated feeds vs farm produced feeds.

ii) Production Management Aspects
- grain introduction systems
- indoor feedlots
- outdoor feedlots
- supplementation at pasture
- sheep behavioural aspects (shy feeders)
- disease control or prevention

iii) Economic Management Aspects
- market requirements
- seasonal variation in stock prices
- method of selling (auction vs direct delivery)
- costs of feedstuffs, drugs, transport, commissions
- opportunity costs and benefits
- deaths and "non performers" - allowance for, and management of.

This listing is far from complete. However, it does give some indication of the sort of subjects requiring at least thought and in some cases action on the part of a person wishing to make the best return from production feeding.

To us there appears to be two areas of production feeding of sheep for meat production which may be profitable. These are -

i) out of season prime lamb
ii) out of season live shipping sheep
Consequently we have worked with these objectives to obtain performance figures which will allow estimation of likely profitability.

Feeding of cereal grains for growth of sheep has resulted in cases of nil growth for a lot of grain consumed through to cases of excellent growth for comparatively little grain consumed. The variability of these results is not surprising when we consider the nutritional needs of growing sheep.

Young sheep (weaners) require about 18 per cent crude protein in their diet to achieve maximal rates of growth. As the age and liveweight of the sheep increases, the proportion of crude protein in the diet required to maintain high rates of growth falls until you reach mature sheep of about 40 kg which require about 12 per cent crude protein to achieve best growth.

Cereal grains vary in crude protein content from 7 to 16 per cent with a usual range of 9 to 11 per cent. Further, in feeding that grain in the paddock the sheep is also eating pasture or stubble which during summer, may vary from 3 to 10 per cent crude protein. Thus diets of cereal grain plus pasture or stubble will not, usually, supply sufficient crude protein for best growth in adult sheep, let alone in young lightweight sheep.

Lupin grain contains about 28 per cent crude protein and is one of the most readily available sources of crude protein in the Western Australian farming system. At Newdegate Research Station in the summers of 1978 and 1879 rations of various mixtures of oat and lupin grain were fed to Merino wether weaners stocked at rates recommended for that district. The weaners were fed as much as they would eat from self feeders. Results of these experiments are summarised in Figure 1 and Table 1.
Mulesing of sheep is still the best available method of controlling breech flystrike in sheep.

Over recent years two factors have become apparent:

i) Radical mulesing with a butted tail reduces fly protection particularly in scouring sheep.

ii) Radically mulesed sheep with a butted tail are more prone to rear end cancer.

In discussing these points factors influencing flystrike will be discussed.

1. Flies affecting sheep in W.A. (Types and numbers)
2. The role scouring plays in flystrike.
3. The role of mycotic dermatitis.
4. Rear end cancer.
5. Mulesing.

BLOWFLIES

The blowflies attacking sheep in Australia fall into three groups:

Primary - capable of initiating a strike on a living sheep.
Secondary - do not initiate strikes but attack an area already struck making the wound more severe.
Tertiary - attack struck areas at a later date - do not injure skin and are of little economic importance.

The flies important in W.A. are:

Primary - Lucilia cuprina (Australian sheep blowfly).
Calliphora albifrontalis (W.A. brown blowfly)
Calliphora nociva (Less brown blowfly).

Secondary Chrysomia rufifacies (Hairy maggot blowfly)
Chrysomia varipes (Small hairy maggot blowfly)
Sarcophaga spp.

Tertiary Australophyra rostrata

Recent figures obtained in W.A. were:
**Incidence of Striketype**

<table>
<thead>
<tr>
<th>Type</th>
<th>% Incidence of Strike</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lucilia cuprina</td>
<td>61</td>
</tr>
<tr>
<td>Calliphora albifrontalis</td>
<td>12 *</td>
</tr>
<tr>
<td>Calliphora nociva</td>
<td>4</td>
</tr>
<tr>
<td>Chrysomia rufifacies</td>
<td>0</td>
</tr>
<tr>
<td>Chrysomia varipes</td>
<td>0</td>
</tr>
<tr>
<td>Mixed</td>
<td>23 (Mostly Lucilia cuprina with the other two primary strikers)</td>
</tr>
</tbody>
</table>

* can be more important in some localities.

**Resistance**

Insecticide resistance in W.A. is not as bad as in the Eastern States.

- 2 - 3 weeks protection N.S.W.
- 4 - 5 " W.A.

**Future Work**

Most insecticide is used as a treatment and not as a preventative. Most of the damage has already been done.

What is required is a method of predicting when flies will be a problem.

i) **Flies:** Are flies present or absent? Numbers of flies present have no bearing on severity of attack.

ii) **Sites:** Knowing when sites on sheep are suitable for laying of eggs and development of maggots. Protein appears to be important in this respect.

iii) **Other Factors:** e.g. rainfall and temperature.

**SCOURING**

Most strikes are breech strikes and most of these are associated with faecal soiling.
From this same trial - ewes which gave birth to the lambs.

EWES | CRUTCH | STRIKE
--- | --- | ---
Control | +ve | 20%
Summer Drench | +ve | 7%
Monthly Drench | +ve | 0%

At Mount Barker Research Station scouring is directly correlated with international parasites.

**MYCOTIC DERMATITIS**

<table>
<thead>
<tr>
<th>Protein</th>
<th>Inoculation</th>
<th>No of Individual Egg Layings</th>
<th>No of Successful Strikes</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;3%</td>
<td>Inoculation with Mycotic Dermatitis</td>
<td>16</td>
<td>14</td>
</tr>
<tr>
<td>0 - 1%</td>
<td>Clean Areas</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

161
**Field Trial**

<table>
<thead>
<tr>
<th></th>
<th>&quot;DERMO&quot;</th>
<th>FLEECE</th>
<th>&quot;DERMO&quot;/F.R</th>
<th>CLEAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nos of Sheep</td>
<td>113</td>
<td>30</td>
<td>41</td>
<td>53</td>
</tr>
<tr>
<td>Prevalence</td>
<td>48%</td>
<td>13%</td>
<td>17%</td>
<td>22%</td>
</tr>
<tr>
<td>% Struck</td>
<td>(47%)</td>
<td>(10%)</td>
<td>(37%)</td>
<td>(0%)</td>
</tr>
<tr>
<td>No Affected</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Strikes</td>
<td>72%</td>
<td>5%</td>
<td>23%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Protein appears to be very important, particularly for development of 1st stage maggot into 2nd stage maggot.

**MULESING**

Trials in W.A. using sheep which were not scouring showed that radical mulesing was probably best with no difference between short and long tails.

Modified mules with a short tail - probably still a need to crutch.

However in scouring sheep the picture would appear somewhat different.

**INCIDENCE OF BREECH STRIKE, IN SCOURING*, MULESED, UNMULESED MERINO WEANERS WITH DIFFERENT TAIL AND WOOL LENGTHS.**


<table>
<thead>
<tr>
<th>SEX</th>
<th>TAIL LENGTH</th>
<th>UNMULESED 5 Months Wool (1975 Drop)</th>
<th>RADICAL MULES 5 Months Wool (1975 Drop)</th>
<th>9 Months Wool (1974 Drop)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EWES</td>
<td>Butted</td>
<td>22/26 85%</td>
<td>9/57 16%</td>
<td>3/51 6%</td>
</tr>
<tr>
<td></td>
<td>Medium</td>
<td>14/17 82%</td>
<td>1/45 2%</td>
<td>3/10 4%</td>
</tr>
<tr>
<td>WETHERS</td>
<td>Butted</td>
<td>18/29 62%</td>
<td>16/57 28%</td>
<td>13/51 25%</td>
</tr>
<tr>
<td></td>
<td>Medium</td>
<td>14/43 33%</td>
<td>0/49 0%</td>
<td>3/56 5%</td>
</tr>
</tbody>
</table>

* Scouring, drug induced.
RECOMMENDATIONS

i) Dock tail to third apparent joint (will cover tip of vulva).

ii) When tailstripping leave a "V" shaped projection of wool bearing skin 3 cm down the top surface of the tail.

REAR END CANCER

Although the vulva is the main area affected, the tail and anus are also affected.

<table>
<thead>
<tr>
<th>Nos of different types</th>
<th>Vulva</th>
<th>Anal</th>
<th>Tail</th>
</tr>
</thead>
<tbody>
<tr>
<td>37</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In one recent study over a period of nine months incidences of 13, 6, 4 and 0 percent were recorded with the majority of cancers starting during the summer and autumn months.

THE DISEASE IS RARELY SEEN IN SHEEP LESS THAN FOUR YEARS OLD OR IN SHEEP WHICH HAVE NOT BEEN MULESED.

Many unknown factors and variables are involved.

i) Environment - worst affected flocks, sandy coastal plains where there is little shade and high temperatures.

ii) Management - as well as the mules operation itself yard construction (weldmesh), shearing and crutching cuts and time of shearing or crutching in relation to sunlight.

iii) Susceptibility - at this stage possible variations between strains of sheep is unknown.

iv) Infectious Agent - agents such as a slow virus cannot be ruled out.

Economics

Say 5 million ewes 5 - 7 years old.

If 1% get cancer 50 000 will be affected.

\[
\begin{align*}
25 000 \text{ ewes} & \times \$20 = \$500 000 \\
25 000 \text{ ewes} & \times \$10 = \$250 000 \\
& \quad = \$750 000
\end{align*}
\]

So for every 1% affected there could be a loss of $750 000.
RECOMMENDATIONS

i) Examine sheep every 2 - 3 months during summer and cull sheep with small lesions or have the lesions surgically removed.

ii) Avoid shearing or crutching in periods of high solar radiation - if not possible offer shade.

or

iii) Mulesing - 3rd apparent joing or tip of vulva.

- "V" of wool on top of tail.
SHEEP DISEASE AND ANIMAL PRODUCTION  P. MckENZIE

The aims of the project are to define the diseases of importance in the Northam area, institute control programmes and evaluate their economic worth.

Table A shows the relative frequencies of some conditions diagnosed at Northam district office (Jan-June 1980).

**TABLE A**

<table>
<thead>
<tr>
<th>Disease</th>
<th>Relative Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Botulism</td>
<td>2.5%</td>
</tr>
<tr>
<td>Lupinosis</td>
<td>2.5%</td>
</tr>
<tr>
<td>Starvation</td>
<td>2.5%</td>
</tr>
<tr>
<td>Scour (weaners)</td>
<td>5.0%</td>
</tr>
<tr>
<td>Water Belly</td>
<td>7.5%</td>
</tr>
<tr>
<td>Mycotic Dermatitis</td>
<td>7.5%</td>
</tr>
<tr>
<td>Nutritional Myopathy</td>
<td>20.0%</td>
</tr>
</tbody>
</table>

The only scouring in adult sheep was one case of salmonellosis from Goomalling.

On four of the first five ewe mobs examined scouring was evident. Range 2.3% to 27.4%.

Nutritional myopathy was a new disease entity. It could be concluded the Department of Agriculture autopsy service is good at detecting new or spectacular conditions but unable to assess levels of old or "lived with" disease.

**Method**

Properties for the study were selected on the basis of ability to co-operate. A visit consists of identifying diseases sheep and then weighing normal and diseased sheep. The investigations are carried through to shearing. The method shows the effect of a particular disease in a mob and should give indications of disease prevalence under various management conditions.

**Discussion**

If scouring is the major clinical syndrome detected in 1980 it will be intensively studied in 1981. The work will not be conducted on a research station but on farms. In short the project could be viewed as developing methods to study disease on farms.
The activities of the Department can be classified under four general headings:

- Investigational or research work
- Advisory or educational activities (extension)
- The provision of services such as farm surveying, wool testing and veterinary post mortems, etc.
- The administration of Acts of Parliament dealing with agriculture.

To carry out these activities, the Department has a staff of approximately 1500 officers.

Of this total number, there are about 70 agricultural advisers located in the south west (from Geraldton south) based at 17 district officers (see Appendix 1).

These advisers I see as the "front line" of the Department as they are where the action is - amongst farmers and conveying the latest information and advice available from the Department.

There are also approximately 200 research staff based largely at South Perth but over recent years being re-located in developing regional centres such as Bunbury, Albany, Esperance and Merredin.

The district office/advisory services are familiar with Department of Agriculture information sources for most farmers. There are also the Research Stations where farmers are welcome to arrange a visit with the manager to become familiar with the Stations research programme. Get to know who the farmers are on your local Research Station Advisory Committee if you have any thoughts on the current research programme. These committees have been set up in recent years to give farmers more say in what goes on at the Research Stations.

Find out through your local district office who has Department of Agriculture research trials on their properties near you. The Department research officers run approximately 500 trials each year throughout the State and many of them should be relevant to your farming operation.
The Journal of Agriculture, established as the "house journal" with the Bureau of Agriculture in 1894 is also probably familiar to most of the States farmers.

Edited by the Information Branch, the Journal was produced each year from 1894 to 1911. Between 1911 and 1924 bulletins replaced the Journal. In 1924, the "house journal" was re-established and bulletins were produced as reprints when needed.

The Information Branch at South Perth has a staff of five professional officers trained in agricultural science and with considerable experience in mass media communications and communications technology.

Our role in carrying out the Departments activities is closely related to the work of the extension advisers.

Rather than the familiar district office advisory services of the farm visits, group meetings, field days and Ag Memos, the Information Branch uses the statewide mass media communication channels. The Branch also has its own statewide distribution system through the Journal of Agriculture and the more recently established Direct Mail Service, Farmnote series and the rural press.

Our Branch also edits the Department's Annual Report which is available each year in January or February. Each Division of the Department produces its own more technical and detailed Annual Report through us, which can be available on request.

The Extension Bulletin series, which is a continuation of the series began in 1911, are publications limited to one topic as are Farmnotes but they require a fuller treatment than can be achieved in the Farmnote format that is limited to four pages.

Extension Bulletins which are more expensive to produce than Farmnotes will all soon carry an individual cost of between 50 cents and one dollar to recover some of the cost of production.

Each week the agricultural journalist of the Branch gathers stories for the statewide press and ABC for release in the Press Bulletin series. Most of the information from the Department in the Countryman, Western Farmer, Farmers Weekly or Elders GM has been supplied through this system.

The television programme "Farming Today" which began 13 years ago from Bunbury Channel 3 should now be available with good reception in the Cunderdin area (see Appendix II). This half hour programme at peak viewing time on a Monday evening is largely produced by officers of the Information Branch, working closely with district advisers.
The development of Avondale Research Station as an historical agricultural museum and a place for metropolitan people to gain an insight into agriculture also heavily involves Information Branch.

Largely as aids to the "front line" advisers, the "Technote" series is edited through the Branch to keep professional staff up to date on important new scientific developments, but not yet published, relevant to the advisers work with farmers.

The Research Projects Data Base is also being developed partly to assist advisers to keep up to date with research work that is current and to easily check the research work carried out by the Department in the past. As the project has only just begun, it will be some time before the past work of the Department can be added to the data base. Information on current research projects is now receiving priority. Farmers will benefit by this project through advisers having more efficient and immediate access to research conducted by the Department.

There are many other information sources of the Department available to farmers through advisers. These include

- plant tissue testing to identify the nutrient status of crops and pastures
- plant pathology testing for fungi, bacteria and viruses, lupinosis stubble testing, annual ryegrass toxicity testing and testing mouldy hay for toxic fungi
- weed and seed identification seed germination tests, seed sample purity tests and past plant identification.
- State Herbarium services including general plant identification including toxic plants
- soil and water quality testing

The development of the Farmnote information sheets, and the Direct Mail Information Service has been a recent successful new approach to an information source for farmers.

The Farmnote, limited to a single topic, well presented, Agdex colour and number coded for easy storage and retrieval can be produced in a short time at a minimum cost. Updating and replacing existing Farmnotes can be readily achieved. The Branch is working towards a total number of approximately 1000 individual Farmnotes on relevant topics in agriculture and aims to keep these Farmnotes as up-to-date as possible.
A specially designed binder called "Agdex for Farmers" will be available at a cost of approximately $10 per copy so that farmers can easily store and retrieve the Farmnotes relevant to their farming operation.

The Direct Mail Service at a cost of $15 per year ensures that you receive the quarterly Journal of Agriculture and the Farmnotes on the topics that interest you (see Appendix III).

Based on the results of a survey conducted early in 1980 we estimate that approximately 20 per cent of farmers in the State are currently subscribers to the service.
NEW INFORMATION SERVICE

The Department's Journal of Agriculture, Farmnotes, and Bulletins can now be sent to your address for an annual subscription of $15.

A unique feature of the Direct Mail Service including all these publications is that besides getting the 32 page full colour Journal four times a year you can tell us what your agricultural interests are and we will send you the leaflets that are published on those topics only.

After we receive your $15 subscription to the Direct Mail Service we send you a questionnaire which lets you nominate the sort of information you want. For example you may specify rangeland management, sheep, beef cattle, water conservation, citrus fruits, vegetables and even home garden information.

As the Department produces information on these topics it is sent to you.

Fill out and return the slip below with your cheque for $15 now and on receival of your subscription we will send you a range of information as well as the questionnaire to get you started on this unique information service.

For further information, contact your local district office

Director
Department of Agriculture
Jarrah Road
SOUTH PERTH  W.A.  6151

APPLICATION FOR DIRECT MAIL SERVICE

Please enrol me on the mailing list for the DIRECT MAIL SERVICE. Enclosed is a cheque/money order made payable to "Western Australian Department of Agriculture" for the amount of $15.

My postal address is :-

NAME  .................................................................

POSTAL ADDRESS .............................................

.................................................................

Office use only:  Receipt No  .................
WOOL FUTURES TRADING BY WOOL GROWERS

WOOL FUTURES TRADING BY WOOL GROWERS

Wool future trading by a wool grower is in essence a contractual agreement by the grower to sell his or her wool at some future date and at a predetermined price. Both parties to a futures transaction are 'hedging' their operation and foregoing the chance of possible higher gains in order to reduce the risk of adverse movements in the price of wool.

In practice futures trading is more complex and transactions are not made between individual sellers and buyers. Contracts to buy and sell are actually made with the Future Exchange and all contracts are transacted by licensed brokers who charge a fee for this service.

Producers who sell wool privately or are in a position to forward sell should consider using wool future as an alternative to forward selling.

Growers wishing to use wool future need to understand and observe a few principles in order to trade profitably. The futures price quoted is the market's judgement of the wool price at a particular month in the future. This price judgement is based on many factors including estimates of supply, demand and currency exchange rates. Futures prices are quoted in cents per kg clean for 22 micron wool of a specified range of wool types.

Wools which are very different from the contract types are a little less suitable for hedging. This is because the actual prices for these wools may not move in complete accordance with the price movements of the 22 micron contract wools.

There is no cash advantage for a grower who hedges his clip every year as there are added costs associated with futures trading. This means that a grower needs to be selective in the use of wool futures, remembering also that the AWC floor price will prevent the price of wool falling below a known level.

Although futures prices are forecasts of the price in the month concerned, they are very much influenced by the current price of wool. This means that a grower who believes that the price of wool is likely to be lower at the time the wool is sold compared with the current price, should consider trading wool futures. Conversely the grower who considers that the price is likely to increase should be less attracted to using futures. However, hedging with wool futures is a good strategy for growers who wish to eliminate the risk of getting a lower price. This can help to guarantee a grower to meet a large expenditure programme.

Potential users of wool futures need to understand how the system works as it is complex and can be confusing. In order to achieve this understanding it is essential to consult with wool buyers and futures brokers. Growers looking to use futures for the first time may do so in a small way. This will enable them to learn how the system for a relatively small cash outlay.
THE OBJECT AND MECHANISM OF THE FUTURES HEDGE

A wool grower can forward sell wool at a pre-determined price by trading in wool futures. In order to do this the grower contracts to sell a certain quantity and quality of wool at a future date by selling wool futures contracts. These contracts are sold at around the quoted futures price for the appropriate month. Later having contracted to sell the physical wool the grower then buys back the contracts at the ruling futures price.

The price guarantee mechanism is based on the assumption that the futures and the cash price of wool will come together as the time to sell the wool approaches. This means that when wool is sold, if the physical market is higher than the contracted selling price, the grower will have to buy back the futures contracts at a price which is higher than the original sale price. The result of this transaction will be a loss on trading futures. The grower's cash price for the wool sold will have risen correspondingly above the contracted hedge price, by an amount about equal to the loss on the futures trade. This means that the guaranteed price will be obtained.

In the event of the physical market going down there will be a profit on the futures trading and this will be about equal to the reduced income from the sale of wool. This again means that the grower receives the guaranteed price.

EXAMPLE OF A WOOL GROWER USING WOOL FUTURES

Grower hedges are initiated by selling futures contracts but before doing this the grower has to calculate the future price which will result from the contract. As futures prices are quoted in cents per kg of clean 22 micron fleece wool, a conversion to greasy prices is usually necessary to provide the grower with a meaningful price.

A grower with an estimated clip of 150 bales averaging 150 kg each produces 22 500 kg greasy wool or 13 230 kg clean wool at 58.8 per cent yield. Assume the wool is usually sold in November. In January of the same year the grower decides to hedge on the futures market. December is selected as the hedging month so that he or she is sure of selling the wool before the futures contract delivery month. Another principle of trading is never to sell contracts covering more than the amount of wool that will eventually be sold. If the quantity of wool covered by futures contracts exceeds the amount to be delivered then the excess cover is speculative. So in this example the grower elects to cover about half the clip, five contracts or 7 500 kg clean wool (12 755 kg greasy).
The grower can then calculate the expected income from portion of the clip hedged as follows:

In January 1979 support the December 1979 futures quote is 410 cents per kg clean, so in January the grower considers selling contracts at 410 cents per kg for liquidation in or before December 1979.

In order to estimate the greasy price which the futures contract produces, the grower compares the price cents per kg greasy for the clip sold in November 1978 with the AWC November 1978 auction price cents per kg clean for 22 micron merino fleece wool type No. 79B.

Suppose the AWC clean quote was 342 cents and the greasy wool averaged 200 cents per kg. This means that the grower's price was 58.5 per cent of the clean price, and this percentage is used to determine the guaranteed futures price. Assuming similar seasonal conditions, and wool clip in 1979 the calculated wool return is 240 cents per kg greasy (58.5 per cent of 410).

Having decided that the 240 cents per kg is an acceptable price for the wool to be sold in October the grower then sells five contracts as suggested for December delivery. Suppose the wool market rises between the time of selling the futures contracts and November to 450 cents per kg clean. In these circumstances the grower makes a loss of 40 cents per kg or $600 per futures contract which is a futures loss of $3 000.

The grower will sell the wool as follows:-

12 755 kg @ 263.3c/kg greasy
(58.5% of 450) $33 584
Loss of futures trading $3 000 + contract charges $227 $3 227
Contracted wool income $30 357

Average price of contracted wool as sold is 238 cents per kg greasy.

(0The above calculation assumes that the futures and the physical wool prices are the same at the time the wool is sold and when the contracts are terminated)

Should the wool market show a decline by 40 cents to 370 cents per kg clean between selling of contracts and the physical delivery and sale of wool, the wool income is calculated as follows:-

12 755 kg @ 216.5c/kg greasy $27 615
(58.5% of 370) $27 615
Profit on futures trading $3 000 - contract charges $227 $2 773
Contracted wool income $30 388

Average price of contracted wool is 238 cents per kg.
The examples show that the grower receives around 238 cents per kg despite off price movements of 40 cents per kg or down between January and November. Thus whichever way the cash price moves the grower can receive a guaranteed price by using wool futures.

It will be noted that this 238 cents per kg is slightly lower than the 240 cents estimated and this is because the charges for the futures transaction amounted to about 2 cents per kg. It is important to realise that there are times when the physical price and the futures price may not be identical at the time the wool is sold. This can occur for various reasons but the divergence is unlikely to be large. In order to be sure that the original estimated guaranteed price is conservative it is suggested that 5 cents per kg be deducted from the estimated price. Therefore in this example the estimated price is 240 cents less 5 cents or 235 cents per kg. This is the price which the grower needs to use when deciding whether or not to hedge.

FUTURES CONTRACT SPECIFICATIONS AND TERMINOLOGY

Unit of Contract - the greasy equivalent of 1 500 kg clean weight of combing wool. (approx. 15 bales or 2 250 kg greasy). (Deliverable tolerance 1 400 to 1 600 kg clean).

Wool Quality - 22 micron good top making merino fleece wool average length (Type No. 79B).

FUTURES

Quotations - in cents per kg clean, and variations are in tenths of a cent (called points in radio reports).

Deposit - $400 minimum per contract payable on opening and refunded at termination of the contract. The deposits vary from time to time according to rulings made by the Sydney Exchange (Deposit requirements can also vary between brokers).

Delivery Months - March, May, July, October and December up to 18 months ahead.

Termination of Trading - the 23rd day of the delivery month or the immediately preceding business day.

Margin - $15 per 1 cent movement or the amount specified by the broker.

Costs of Futures - cost of selling and buying each contract is $45.40.
GROWERS INTENDING TO USE FUTURES NEED TO PAY SPECIAL ATTENTION TO THE FOLLOWING ASPECTS:

. When calculating the price the wool quality must be similar to that specified. Merino 22 micron (range 19.5 micron to 23.5 micron).

. When estimating the price using last year's clip as a base the assumption is that next year's clip will be the same quality. Altered seasonal conditions or wool types will invalidate that assumption. It is also necessary to ensure that the physical and futures prices were similar at the time when the wool was sold.

. The contracts must be liquidated as near as possible to the time of selling the wool.

. The broker can call for margin payments from the grower if the futures market moves adversely from the contract price. For example if the contract is sold for 410 cents and the market moves up to 430 cents the broker may call for $300 margin per contract to cover this movement. The margins are returned to the grower if the market moves back to the original contract price, or they are recouped by the grower at the time of liquidating the futures contracts.

. It is imperative to consult with wool brokers and buyers to ensure a full understanding of how the system works and how it will relate to a particular clip.

. Wool futures trading provide a flexible selling system for wool growers as the number of contracts can be altered prior to the sale of wool depending on market trends. This can only be effectively done by constant monitoring of the market.

. Futures contracts should be liquidated no later than the last day of the month prior to the contract delivery month. Failure to do this can mean that a buyer can exercise the option to take delivery of the wool contracted for sale.