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W.A. DEPARTMENT OF
AGRICULTURE

Written By Geoffrey Pearce

The Department Of
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The Problem of Weeds
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**The new cropping
industry”**

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By Geoffrey Pearce

The story which follows tells how the systems for planting cereals, developed on research stations over a period of about 40 years, has been changed by a Commercial Chemical Company using newly developed herbicides to replace cultivation.

The Department Of Agriculture in WA

From the beginning of settlement in WA the need to provide food for the growing population meant that farming quickly became the most important industry. In order to teach the new farmers how to grow cereal crops in a new climate and with basically poor soils, successive State Governments established demonstration farms. The first of these were at Geraldton (Chapman) Beverley (Avondale) Merredin and Wongan Hills. These were later called research stations and by the 1960's there were 18 established throughout the state, servicing the various branches of agriculture.

Over the years research workers established the need for numerous minerals required by plants to grow in the different soil types. Tillage trials defined the most suitable type of machinery for preparing the seed bed for cereal crops. The establishment of sub-clover pastures gave a great boost to crop yields through nitrogen build up in the soil. One particular research subject which had important implications many years later, was a time-of-planting trial. This was carried out at three research stations on new land for 3 years (1931-1933). Providing rain was received, it was found that wheat planted in April gave a higher yield than when planted in May, which in turn gave a higher yield than with a June planting.

This same effect could be seen years later, in the 1960's when the number of cultivations was reduced and so allowed earlier planting using minimum tillage principles.

While successive State Governments maintained a policy of releasing new areas of land for farming, a special effort was made after the two world wars and the great depression of the 1930's, to speed up the development.

At the end of the First World War the higher rainfall areas of the south west were subdivided for returning soldiers to establish dairy farms and a timber industry. In the 1930's the government turned to the drier areas to establish wheat and sheep farms. The new farmers could visit the government demonstration farms to learn how to plant and grow cereal crops.

At the end of the Second World War the State Government set up the War Service Land Settlement Department. With the assistance of the Department of Agriculture new farms were developed and when they were self-supporting, they were allocated to ex-servicemen.

To diversify the operation, crops were planted every 2 or 3 years and in between sheep were grazed on the resting land. To provide food for the sheep, pasture seed usually sub-clover and rye grass was sown with the cereal for use in the following years.

The Problem of Weeds

As the rotation of sheep and cereals was followed for a number of years, plants which could survive and grow with the cereals and also pastures became problems as weeds. To reduce their competition with the growing crop the land was cultivated several times before planting. However there were always weeds growing in the crop and the more years of cropping carried out, the worse the weeds became, requiring additional cultivation.

Modern Selective Weed Control

The very profitable agricultural chemical industry of today was born out of research carried out during the Second World War. The chemicals 2,4-D & MCPA were developed with the intention of spraying and killing enemy food crops. This wasn't practical but it was found that many weeds could be killed by a spray application of these herbicides on some crops which were completely unaffected.

Tested in WA it was found many of the common weeds were readily killed by the spray while cereal crops were not harmed. Farmers could spray the crops after the weeds had all emerged, or have the herbicide applied by aerial spraying with an aircraft.

The potential for chemicals, developed for agricultural use, was quickly seen by the already existing Chemical Companies who manufactured pharmaceuticals, cosmetics, fertilisers, mining and other industrial products. Many of these companies soon developed new chemicals which could be used for a wide range of weeds growing in a variety of crops.

Royal Commission

At the end of the Second World War the WA state government held a Royal Commission into the problems of vermin and weeds. It recommended the formation of the Agriculture Protection Board within the DOA to be responsible for the control of Declared Vermin & Declared Noxious Weeds.

To provide the technical information on weed control required by farmers shire councils and other interested groups, a new branch was created in the Biological Services Division named The Weed Control & Seed Certification Branch. The Assistant Government Botanist, George Meadley was appointed Officer in Charge. He had been responsible for the certification schemes established for pasture seed production and also the crop spraying industry for weed control.

In 1949 Brian Quinlivan was appointed to the staff to work on the agricultural seed aspects of the branch. In 1952 I was the second agricultural graduate to join the staff and allocated to work on weed control. Brian was eventually awarded a Doctorate for his work on clover seed dormancy while I earned a master's degree for investigation of factors causing the sprouting of Cape Tulip. When George retired in 1974 the Branch was transferred to the Plant Research Division. I was in charge of the Weed Agronomy Branch

ICI's Sprayseed System for Planting Crops

Two ICI herbicides, Diquat & Paraquat were registered in the 1960's for the control of annual broad leaved weeds and grasses. These two compounds had been under test for several years in other countries to kill young weeds in cropping situations. They mixed Diquat with Paraquat and produced a product they called Sprayseed. The ICI system was to kill the germinating weeds with a single application of sprayseed without causing further weed emergence.

In order to establish a commercial market in 1971-72 they appointed field officers to visit selected farmers to persuade them to plant a whole paddock using the ICI Sprayseed System. This could then be compared with adjacent crops planted using the old system. ICI decided to go for the radical alternative to cultivation, using a boom spray and standard combine. With great excitement the "Spray-seeding" concept was launched in October 1969 at Northam.

The Department of Agriculture & Sprayseed

From the beginning of the Sprayseed Promotion Scheme, ICI was keen to have the DOA involved. However to test changes to the tillage system and prove their value would have required far more trial work than using a single treatment over a whole paddock as ICI were doing.

The Department of Agriculture was quite justified in the 1970's not to endorse ICI's marketing scheme to replace cultivation with a herbicide spray. There were no experimental results to support such a change.

The Director of Agriculture and his senior officers may well have had bad memories of a similar type of approach from an American Company, to develop new farming land at Esperance in the 1960's.

A research station was established at Esperance in 1949 and in the next ten years developed a system to convert native vegetation land to clover pasture associated with cereal crops.

The State Government sold a large area of virgin land to the American Chase Syndicate who were to develop it into fully operating farms for sale to the general public.

The recommended development system included leaving the cleared land for a year as fallow to control certain soil organisms. The American Agronomists decided that the fallow year could be discarded and the same benefit gained by the application of a nitrogen fertiliser. Unfortunately changing the tried and tested system failed and a year in the development programme was lost.

Meanwhile field officers trained by ICI very quickly gained experience to advise farmers and organise field days to publicise the good results being obtained. Farmers like to experiment themselves and so the interest in minimum tillage cropping grew in popularity without a great deal of comment or support from the DOA.

ICI accelerates the sale of Sprayseed

The life of a patent is limited to a certain number of years so that ICI needed to expand their market for Sprayseed as quickly as possible. While sales had been steadily increasing, in 1975 they decided to try and win the support of government researchers throughout Australia in promoting the new planting techniques. This was done by inviting them to join a tour organised by ICI to visit Research Centres in the UK, USA & Canada to inspect work being done on reduced tillage.

The DOA supported my application to the State Wheat Research Committee to join this tour. Unfortunately I was the only applicant from around Australia, and the trip was cancelled. Fortunately ICI arranged a private tour for myself and in 1976 I visited the three countries.

As expected, I found Government organisations working alongside these international chemical companies research centres, received a lot of advance information on products compared with far away places like Australia.

After seeing a plot of wheat which had been planted every year for 90 years, I asked ICI to provide the DOA with two Bettinson Drills so that plots could be planted without any cultivation. They readily agreed and supplied one drill for use at Avondale and Mt Barker research stations and another one for use at Wongan Hills and Merredin research stations. The Bettinson drill cut a slot into which the seed and fertiliser is dropped.

On my return, after writing a favourable report on all I had seen, I set about planning a reduced tillage program trial incorporating the sprayseed system. One treatment was to plant the cereal without any cultivation using the Bettinson drill and the comparison treatment was to be the same as the district practice as used by the research station manager. The other two systems involved cultivation with Sprayseed applied at different times. Planting was to be undertaken as soon as practical on each system, so that planting could vary by as much as 4 weeks. The first results from the 48 plots were obtained at the end of 1977 and the treatments were repeated in 1978 on the same plots. About this time and unknown to me, an unofficial committee had some meetings to discuss the subject of minimum tillage planting techniques. After I had commenced the 1977 trials the committee realised they would have to involve me and invited me to a meeting. They wanted me to change the design of the trials by only comparing single treatments rather than systems combining several treatments. The whole site would have to be planted at the same time. I refused and carried on with the trials as planned. I never had any further contact with the committee even though I was a member of the same division.

In order to overcome this divided interest in 1978 Ron Jarvis was transferred to Perth to co-ordinate all minimum tillage trials undertaken throughout the department. He was appointed Tillage Research Officer in 1980. I had no further involvement with the minimum tillage program after 1978. During the next ten years the Department of Agriculture carried out about 200 crop trials throughout the cropping districts to test reduced tillage systems. During this time many of the departmental Extension Officers supported and promoted the principles involved.

Because of the wide diversity of soils and rainfall and other weather conditions experienced throughout the cropping districts, it was soon found that changes to the planting system had to be made. Some of the problems solved included the following;

- A hard pan development in some light soils was overcome with deep ripping, which also increased the yield.
- Retaining stubble assisted in moisture penetration and reduced evaporation compared to areas where stubble had been burnt. A higher yield was also obtained.
- Cultivation to a greater depth than where the seed was planted resulted in higher yields when the fertiliser was placed at the lower level.

A widespread experimental program was carried out to determine how common these sort of problems were.

ICI's Achievements

In 1970 ICI started selling and promoting the use of Sprayseed to eliminate much of the cultivation usually required planting a wheat crop. In 1977 ICI sold 200,000 litres of sprayseed, sufficient to treat the same area of crops. In 1977 the Weeds Branch commenced their first minimum tillage trials using Sprayseed at four research stations and planned to run the trials for at least 3 years. While numerous DOA extension officers saw ICI's results and modified their own advice this was without any results or guidance being available from the DOA. In 1980 ICI's sales approached 1 million litres of Sprayseed, a very satisfactory commercial market. In the same year the Department of Agriculture appointed Ron Jarvis as the first Tillage Research Officer. By the turn of the century probably half the annual crop was planted using some form of minimum tillage.

The Department of Agriculture gets on board.

In 1991 the Department of Agriculture published "The Wheat Book," a technical manual for wheat producers. This was funded by the Wheat Research Committee of Western Australia and distributed by the Australian Wheat Board to the wheat growers of W.A. It covers all aspects of wheat cropping and summarises the result of much research carried out over many years. It is an excellent publication.

In chapter 7 of the book on Tillage and on page 120, reduced or direct drilling is recommended on 5 of the 6 soil types listed. However on page 121 it states that "the advantage of cultivation over direct drilling with a direct combine has averaged 0.27 ha over 10 years from more than 200 Department of Agriculture trials." On the two tables shown, 7.1 and 7.4, it states that all treatments were sown on the same day. It is probable that the single time of planting applied to most of the 200 trials mentioned.

One of the main advantages of discarding one or several cultivations before sowing is that the length of the growing season is increased by 2 or 3 weeks. The time of planting trials over the years have shown that an increase of yield will be obtained from a longer growing season resulting from earlier planting.

Changes to the Cropping Industry over 30 year

In 2008 Mr Noel Fitzpatrick, ex Director of Agriculture and generally regarded as the most outstanding occupant of that position since the Second World War, published a book on the history of the Western Australian Department of Agriculture from 1894 to 2008. Being a farmer himself, he appreciated how valuable agriculture research was to the farming industry.

In Part 13 (1970 – 1994) he describes the changes in the methods of planting as follows;

“In the early 1970’s drought and reduced stock numbers, coupled with better returns from continuous cropping resulted in a move away from the clover ley system of farming. Progressively, the industry moved to continuous cropping without a pasture phase.”

“In the mid 1970’s it became commercially possible to selectively, or totally control weeds by spraying with herbicides, and this progressively changed the method of planting crops. While this achieved effective weed control, there remained issues such as how much cultivation was needed to provide the necessary seed bed. Within this new framework developments took place which totally changed the cropping process and the potential for yield, particularly in the medium rainfall districts.”

“From a research and developmental aspect there were new challenges. New varieties had to suit the longer season, the new nutrient cycle needed to be understood, the level of cultivation for seedbed preparation and nutrient mobilisation needed study and the appropriate rotation to establish a sustainable agriculture had to be defined. Experimental work and farm innovation resulted in further changes to the cropping system.”

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“The clear advantage of the new approach was that even if the farmer waited for the first rain, he sowed his crop with one pass, considerably earlier than was possible when weeds had to be killed by cultivation.”

“This meant that the growing season could be extended by up to three weeks. Moisture loss due to cultivation was avoided and more moisture was available for crop growth.”

Conclusion

The story outlined records how the planting systems developed on Research stations, and used over a period of 40 years, have been dramatically changed. We might well ask why minimum tillage principles have been so widely adopted by the farming community. One important advantage is the increase in the length of the growing season at a time when annual rainfall is in decline.

In W.A. most of the cropping districts have a growing period of about 4 months. If several of the cultivations used to kill weeds at planting time are replaced by a spray then planting can be commenced about 3 weeks earlier. **This would increase the area planted by about 20% to be added to the farm production.**

The benefits from the universal adoption of one pass planting includes:

- Larger area of crop planted by individual farmers.
- Same size machinery.
- Fewer farmers with large farms; family labour.
- Fuel savings contribute to the cost of herbicides.
- Greater use of early rains compensates for declining annual rainfall.