AUSTRALIAN AGRICULTURE

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Agriculture in Australia is sometimes hard, sometimes bountiful, but always full of opportunity.

Wherever and whenever agriculture is undertaken it is a battle against the vagaries of the climate and the markets. These battles have to be fought as long and as hard as in any agriculture in the world. In Australia, the dry continent, rainfall is low and uncertain.

In Australia, the big, distant country with the small population, farmers have to sell much of their production to the rest of the world, far away. In Australia, farm families are continually having to leave agriculture: either fewer farmers or poorer farmers is one of the rules of the game. Agriculture in Australia is about confronting difficult and constantly changing natural, economic, technical and social circumstances. It is about a strong tradition of scientific research producing a steady stream of productive new ideas, technology and opportunities. It is about farmers continually increasing their productivity more rapidly than any other part of the economy. It is about food and fiber being produced extremely efficiently. Agriculture in Australia is also about a much loved way of making a living.

Agriculture is considered in relation to production, profit and sustainability—three concepts which are neither distinct nor mutually exclusive, but which are directly and closely related. Agricultural businesses will not be sustainable in the long term unless they are productive and profitable, and agricultural businesses will not remain productive and profitable over time unless they use resources in sustainable ways.

In Australia only about 6 per cent of the land can be used to grow crops and pastures. Another 60 per cent of the land can be used for non arable agriculture. The remaining one third of the land has no agricultural uses. Still, 48 million hectares of land in Australia has a climate and water supply which is well suited to highly productive, arable agriculture. In world terms this is still a very substantial area of useful agricultural land. Indeed, in terms of the relatively small population, the amount of agricultural land per person is large compared with most parts of the world.

In Australia, agricultural production makes up 3 per cent of the total value of goods and services produced in the economy each year, and about 4 per cent of the total work force is directly employed in agriculture. Even though the relative share of agriculture in the national economy is small, agriculturally related employment is significant and agriculture earns a significant share of national export earnings. Unprocessed agricultural commodities make up around 25 per cent of Australia's exports each year. This share is around 35 per cent of exports once manufactured agricultural products are considered.

Farming in Australia is different from farming in other regions like the U. S. A, Western Europe, New Zealand or maybe even Canada because the natural conditions, heavy reliance on free markets and highly competitive export markets combined to make agriculture in Australia a particularly difficult, uncertain and risky endeavor. Australian farmers generally have to compete to sell their products on world markets without the subsidies which their U S and European counter parts receive from their tax payers and consumers. Thus Australian farmers have to be, and generally are, highly efficient.

CLIMATE and SOIL

The most notable feature about Australian agriculture is the extent to which net farm income varies from year to year, largely because output varies greatly. This is because the key climate variables, especially rainfall, vary greatly around their expected levels, both within a season and between years.

Australia is a huge land mass, and a very dry one. 80 per cent of the land receives an annual average rainfall of less than 600 mm, and 50 per cent of the land receives less than 300 mm. The vast dry centre area receives less than 200 mm of rain each year. Moving out from the arid centre in every direction the annual average rainfall increases steadily.

The arid centre is surrounded by a semi arid area which receives 200-400 mm per year, and in the temperate coastal regions of Southern and South Eastern Australia some 400 to 1,000 mm falls per year. A distinguishing characteristic of Australia's rainfall is that it is highly variable over a large proportion of the continent. Unexpected dry periods and droughts are an inevitable and frequent feature of Australian agriculture, and most farmers develop strategies to deal with them.

Australian soils have developed from highly weathered and deeply leached parent materials. Generally the soils are deficient in the major and minor nutrients which plants need to grow, especially phosphorus. As well, the soils are usually low in organic matter. The total area of soils with properties that make them suitable for agriculture, and which receives sufficient rainfall, is only a small proportion of the total land area.

In total, only a small area of Australia has soils with the valuable characteristics of being deep and well drained, with high fertility and high water holding capacity. Farmers generally have to make do with much poorer soils. This means that farmers have to manage soils of only moderate fertility. These are relatively shallow, have poor water holding capacity and low nutrient status, and are capable of only moderate fertility and low yields relative to international competitors.

Along with climate and land, another major factor which determines the feasibility of agricultural activities is the quantity and quality of the water supply. By world standards, Australia's rainfall and water supply is generally low and highly variable. The run off of water into rivers, and the river flows, are seasonal and highly unreliable. Despite this, irrigation for agriculture has been expanded since the early days of Australia's development, and now days Australia has over 1.5 million hectares of irrigated land, located along all the major rivers.

Problems of soil salinity have emerged in some of the irrigated areas, as a result of adding water to water tables which are shallow and often already saline. Downstream river water is becoming increasingly saline as well, which poses potential problems for downstream irrigators and other users of water.

AGRICULTURAL ZONES

THE HIGH RAINFALL ZONE

The high rainfall zone receives the highest rainfall of Australia's agricultural areas, receiving on average over 500 mm each year. The high rainfall zone is used mainly for grazing based on improved pastures and high stocking rates, with some broad acre cropping. The dairy industry is located within n the rainfall zone in each state. The average herd size is steadily approaching 150 cows, although increasingly herds of 200, 300 or even more cows are being milked.

This region also contains arable land but sheep and cattle grazing are the main activities. The growing season ranges from 6 to 9 months. The region carries about 30 per cent of the national sheep flock. Prime lamb production is important throughout. Cropping as a management option is increasing. Oats, barley and canola maybe grown for grazing and fodder or grain, which is then sold or stored for supplementary feeding.

THE WHEAT SHEEP ZONE

The wheat /sheep zone is the second most important zone of agricultural production. About one third of Australia's agricultural output is produced in the wheat/ sheep region, including nearly all the wheat grown. This zone has a growing season from 5 to 9 months. The climate and topography suit regular cropping accompanied by sheep or beef grazing on improved pastures. Nearly 75 per cent of properties produced sheep, wheat and barley, accompanied by grain legumes, pulses, and oil seeds in the crop rotation. The wheat /sheep region carries nearly half the national sheep flock.

The wheat producing areas receive between 250 mm and 600 mm of rainfall each year, most of which falls in the winter and spring. Soils used for wheat growing are generally are of only moderate fertility, ranging from sandy loams to heavy clays. Short annual pasture phases are grown when a ley farming system is used. Improved

pastures use annual medics in the drier areas and subterranean clover where rainfall is higher.

THE NORTHERN PASTORAL ZONE

The Pastoral Zone covers the arid and semi arid areas of Australia. Rainfall is very low, and the main land use is to graze native pastures with low stocking rates over large areas. The sector comprises an immense land area- one quarter of the total land used for Agricultural production in Australia. Beef cattle production is the major activity. The far north of Australia has a highly variable monsoonal type of wet season followed by high temperatures. Soils are very poor and grazing is based on tropical grasses of low nutrition.

THE SOUTHERN PASTORAL ZONE

Most of this sector is south of the Tropic of Capricorn and merino wool growing is the main activity. Properties are large and flocks of 5,000 to 20,000 head are common. The major plant species used in sheep production are the ephemeral grasses which appear after the rains. These native pasture species are well adapted to the low, variable rainfall, but they produce little dry matter and cannot withstand heavy grazing.

INTENSIVE FARMING

Sugar cane is grown mainly on the north and central coasts of Queensland. Typically, around 25 million tones of cane is produced in Queensland each year, equivalent to over 3 million tones of raw sugar. 80 per cent of this raw sugar is exported Australian sugar exports make up about 10 per cent of the world trade in sugar.

Major crops grown under irrigation are rice, irrigated pastures, fruit, vegetables and ornamental plants.

Other small but significant activities include the pig industry and the egg and poultry meat industries.

CAPITAL

Australia's agricultural sector comprises mostly family operated farms, with very few farms operated as public or large family companies. Nearly 85 per cent of all holdings are family partnerships, 12 per cent are run by sole operators and about 3 per cent are companies.

One of the most notable features about Australian agriculture is that net farm income varies greatly from year to year because prices and yields fluctuate greatly. Often the best response to risks is to diversify the sources of cash flow to beyond the farm gate. It is common for farmers to have off farm investments, and sometimes members of the farm family partnership earn income off the farm.

The type, location and profitability of Australian Agricultural activities is determined by natural and market conditions. The outstanding characteristic of the Australian way of farming is the high level of risk. Farming requires continual increased in productivity in order to remain profitable. The forces of economic growth mean that there is a need for less and less farmers who are more and more efficient. Most farmers have continually improved their productivity at a faster rate than occurs elsewhere in the economy. As well, farmers have left agriculture quickly enough to enable those who remain, to earn a reasonable living. The result is that agriculture in Australia remains an efficient sector of the economy and a significant source of export earnings.

SUSTAINING RESOURCES

Since European occupation the productive capacity of Australian farmland has changed markedly: mostly for the better through pasture improvement and improved cropping practices but in some areas for the worse.

Agriculture in Australia has had an export earning role almost from the start of European occupation. Australia had large areas of clear, flat and watered grazing lands, and agriculture- mainly grazing- was based on low labor inputs and low capital inputs on large areas of land. Large areas of Agricultural land per head of population have always been the principal source of Australia's comparative advantage in agriculture over most of the rest of the world.

One of the surest ways for a farm or farming enterprise to be unsustainable in the medium or longer term is for that farm to be unprofitable. Unprofitable farms are NOT sustainable and unsustainable use of resources makes farms unprofitable, over the longer term at least. The majority of farms which have a profitable future also have the incentive to preserve and maintain the resources they use for the longer term.

Soil erosion through wind and water are issues Australian farmers have been confronted with along with soil acidification and salinisation.

More than 25 million hectares of Agricultural land in Australia has strongly acidic soils, with a soil pH in water of less than 5 .5. Soil acidification is a natural process which generally occurs as soil undergo further weathering and lose nutrients through leaching. There are, unfortunately, a number of farming practices, such as the use of productive legume based pastures or the use of nitrogen fertilizers, which accelerate the soil acidification process.

Soils become saline when there is a build up of salts (mainly NaCl) in the root zone. The build up in salts results from rising underground water tables. As the water table rises it brings with it dissolved salts from deeper sub surface layers. Dry land salinity results from the clearing of native perennial vegetation, particularly woodland and forest, to grow annual crops and pastures. The annual plants use less water, so more water that has fallen as rain will drain through the soil profile below the root zone and enter the groundwater, causing the water table to rise. The effects of this land clearing, which occur in the lower parts of the landscape where the rising water table will discharge may not become apparent for many decades. The dilemma is how to correct the problem which has been developing for many years. Reintroducing perennial crops and pastures to the landscape may be one option. Some soils have lost productive capacity from acidification and salinisation, at the same time, many are more fertile and productive than ever before.

One objective of Australian farming practices needs to be that the most serious degrading processes are prevented and severe damage corrected, if agriculture is to be truly sustainable. Appropriate alternative practices are available to achieve these goals.

One innovative program that has developed sustainability indicators is the Right Rotations Cropping program in South Australia. Instead of relying on trends in yields, disease, weeds and gross margins, to tell the sustainability story, the program gives points for practices involving nitrogen management, amount of tillage and stubble retention. A final score gives some measure of the well being of the cropping system for that paddock.

Profitability and sustainability of resources are intricately linked.

IMPROVING AGRICULTURE

Improvements in crop and animal productivity have to continue on Australian farms in the future. Improving the efficiency of production processes means more is produced for the same cost, or the same amount is produced but the cost of production is reduced. The key outcome is the reduced unit-cost of production. There are two particularly compelling reasons why this must happen. The first is the continuing inevitable decline in the prices receive for production relative to their production costs, and this will occur as the rest of the economy grows. This means that farmers' continuing viability will depend, as it has in the past, on improving the efficiency of production processes.

The second reason is that Australian farmers must compete with other countries that export primary products in the global economy, and these competitors are continually increasing their efficiency, or are supported by Government subsidies.

Since the beginnings of the Australian grain industry in the middle of the nineteenth century, six generations of Australian farmers have strived to produce high-yielding crops in order to earn a living from their farms. Significant increases in yields of wheat, the country's staple cereal crop, have occurred, although the magnitude of productivity gains has been limited by climatic constraints.

Looking back over the last 150 years of crop production, the inescapable conclusion is that Australia's grain growers have been in a continual struggle to come to grips with growing annual dry-land crops in the difficult Australian environment. There has been a steady development in understanding the limitations on crops performances imposed by the climate and the soils and how best to manage these constraints. Innovative farmers, agricultural scientists and inventors have all made major contributions to this development. The outcome has been a continuing change in farming practices as production problems are identified and alternative practices are adopted to overcome problems and limitations.

THE FIRST FIFTY YEARS (1850-1900)

Grain farming in southern Australia began to expand during the 1860's as railway networks were built through cropping country. At the same time the availability of land for cropping increased as a result of a determined government policy to achieve closer settlement.

The early farmers attempted as best they could to maximize profit by growing crop after crop. This practice of continuous cropping led to nutrient loss. The difficulty was that many of the soils were already low in N & P. As a result, grain yields could not be maintained, yields declined as repeated cropping continued to deplete soil nutrient supply. BY the end of the nineteenth century average wheat yields had declined to almost half of what had been achieved from the virgin cropping land in earlier years.

THE SECOND FIFTY YEARS (1900-1950)

Three changes in farming practice led to a marked improvement in crop yields after the turn of the century. The first was the increasing use of single super phosphate as a fertilizer to supply P, which alleviated the widespread P deficiencies that had developed with continuous cropping on soils that were naturally low in P. The second was the long fallow, involving growing a crop every second year after the soil had been maintained in a cultivated, weed-free state during the previous summer, spring and autumn. The fallow generally resulted in higher soil moisture levels at sowing, and increased N availability from the breakdown of organic matter that occurred during the fallow phase. The third change was the use, from about 1901, of the new, early –maturing wheat cultivar called "Federation". Bred by William Farrer. This wheat cultivar was able to mature much earlier and was therefore less constrained by the normally hot, dry finish to the wheat crop.

THE THIRD FIFTY YEARS (1950-TODAY)

Legume ley-farming was being developed, but its adoption required favourable markets for livestock and livestock products. The "wool boom" in the early 1950's led to its rapid and widespread adoption by farmers. The practice was to establish a legume based pasture for a number of years (usually 2-5 years) in cropping paddocks, and then return the paddock to crops for up to 3 years. Thus a rotation was established for a particular paddock where a sequence of crops were followed by a number of years of pasture, before returning to the cropping sequence again.

Part of the answer came in the form of a crop management strategy known as CONSERVATION FARMING, which had two major aims: to reduce the frequency of tillage in crop production, and to retain crop residues on the soil surface to protect the soil from erosion.

There was a trend towards continuous cropping, and rotations were established where the cropping sequence alternated regularly between grain legumes or canola (or both) and cereals such as wheat, barley or triticale. Continuous cropping, together with direct drilling and stubble retention, became a profitable farming system in the more favourable cropping regions of the Southern Australia. However, this seemingly profitable cropping system soon developed major problems, which has been the pattern for all new cropping systems in this country just when farmers became reliant on them. In the late 1980's and early 1990's the cause of the problem was the development of herbicide resistant populations of annual ryegrass in cropping paddocks that had been repeatedly sprayed with the grass-selective herbicides.

You may note that all farming systems developed so far to produce higher grain yields on Australian cropping land have not been sustainable. Agricultural scientists in the future need to be very aware of this pattern over the last 150 years. It is likely that the pattern will continue and there will be a continuing need to devise new farming practices to overcome biological, economic or social problems that occur on Australian cropping farms.

IMPROVING CROP YIELDS

A theoretical concept of potential yield was developed by a South Australian Agronomist Reg French, who suggested that wheat yields in southern Australia are directly related to g rowing season rainfall if all other limiting factors such as nutrient deficiency, weed competition and root diseases are eliminated and the timing of operations are perfect. Reality, of course, is not like this, but an estimate of a crop's potential yield in this area can be made by first calculating the approximate amount of water used by the crop. This is done by adding the amount of moisture stored in the soil profile at sowing to the May-October rainfall (both in mm) Then a figure of 110 mm, which is the unavoidable loss of water by soil evaporation, is subtracted from the total. Finally, the net water use by the crop is multiplied by 20 to give the potential theoretical yield.

For example: if the approximate soil moisture levels at sowing were around 50 mm, and the May-October rainfall was 295mm, the theoretical potential yield under perfect conditions would be 4.7 t/ha. Unfortunately in the real world other limiting factors do exist and on many Australian farms grain yield is only about fifty per cent of yield potential, given rainfall.

One of the major management tasks on a cropping farm is to set up the most appropriate rotation. The right rotation will control root diseases if non-grass phases occur before cereal crops. The rotation will have an important bearing on the N status of the soil. There are two options here. The first is to include grain legumes in a rotation and to use some N fertilizer in non-legume phases. The second is to include a legume-dominant pasture phase which supplies more N than that from grain legumes and requires less n fertilizer for the non-legume phases of the rotation. In the poor seasons that occurred in the early 1990's many grain farmers in southern Australia who were relying on continuous cropping with grain legumes, herbicides and fertilizer nitrogen found that profits with low yields were eroded by the costs of the extra in-puts. Their thinking is now changing towards adopting less intensive, lower in- put systems with perhaps lower yields and lower risks. A vigorous pasture/ legume phase, which provides N, improves soil structure, controls root disease and facilitates weed control, will feature more in this approach.

The choice of the tillage and stubble management system is another major decision facing the grain farmer. Obviously there is a need to eliminate excessive tillage practices in an attempt to maintain a favourable soil structure and organic levels. But the question will be whether a continuous cropping rotation, even with direct drilling, will be sufficient to optimize soil conditions that are required for high yields. The alternative to the continuing cropping rotation will be to include a pasture phase. Retaining crop residues for as long as possible is necessary for erosion control.

Finally, the grain farmers needs to adopt a whole suite of sound agronomic practices in order to produce high yields and high gross margins. The crop has to be sown around the optimum sowing date, nutrients requirements must be met and it must be protected from pests and diseases.

Although productivity gains in agriculture are difficult to measure accurately, the evidence is that in Australia gains have been in the order of 2-3 percent per year for at least the past three decades. Investment in research is a major source of improvements in productivity. Farmers also stand to benefit from potentially large efficiency gains beyond the farm gate, such as in processing, in transport and handling.

There are now fewer Australian farmers, each producing more farm product than ever before. In response to the continuing pressures on their net incomes, farmers everywhere are increasing productivity by continually

changing their operation.-intensifying, expanding, and readily adopting profitable new techniques. Improving agricultural productivity is the key to sustaining agriculture in Australia.

New technology and management practices evolve, and competition with other producers, locally an abroad, makes it imperative that new technology and management practices are adopted just to stay in the game.

(End referencing *'Agriculture In Australia – An Introduction.'*)

OUR FARM

Our own farm is situated in a geographically isolated part of the Southern Australian wheat belt. At the bottom end of the Eyre Peninsula, some 700 kilometers by road from Adelaide (the capital city of the state of South Australia) we have an 18 inch rainfall and variety of soil types. The southern ocean is within 50 kilometers in three directions (west south and east) and gives our Mediterranean climate a distinct maritime influence.

My parents, grandparents and even great grandparents have all lived and farmed in the area which was opened up for settlement in the early 1900's. Dense scrub covered the land and had to be cleared before cultivation could take place. A railway pushed north from the port of Port Lincoln just prior to World War 1 and greatly encouraged the settlement and agriculture.

One hundred years on and our family farm has grown to 7,000 acres on which we grow wheat, malting barley, canola and pulse crops (peas, beans, lupins and lentils). We also keep merino sheep for both wool and meat production. Our entire grain crop is exported out of the deep sea port of Port Lincoln. Freight to port is only about $5 per tonne, given our proximity to the coast.

Average grain yields across Australia come in at about 20-25 bushels per acre. We farm in one of the more favorable areas (although certainly not the best) and our average yields are about 50 bushels to the acre. Big increases in yields have been made in recent years particularly in the areas with better rainfall patterns. The lower rainfall areas have struggled to achieve comparable yield increases.

You would all recognize immediately the machinery which we run on our farm. A Case IH STX 325 pulls an Australian made seeder box and a Canadian built Conserva-Pak bar. We have used zero-till to establish our entire crop for the last two years, having slowly worked towards that system for the previous decade. Weed resistance to herbicide is rapidly becoming a serious threat to Australian agriculture and zero till in particular. Long term use of the same herbicide group will result in resistance developing. Fortunately this issue is getting much exposure and most farmers are putting in place strategies to delay the onset of resistant weed populations. My greatest fear is that we could lose the effectiveness of our knockdown herbicides i.e.: glyphosate and paraquat/diquat, which are the cornerstone of 80% of the current farming systems in Australia.

It is worth noting that at this point in time, the only Genetically Engineered crop in Australia is BT cotton. In fact every Australian State except Queensland, has a legislated moratorium in place to prevent the commercial raising of GM crops for the next three to five years. As a result, the debate over GM technology has been polarized and is virtually stalled. My concern is that Australian farmers will be left behind those in the rest of the world in our ability to access the benefits of this technology.

A typical crop rotation on our farm would be canola, wheat, barley, lupins, wheat, pasture and then back to canola. Farms are fenced into paddocks (fields) of about 100-150 acres and sheep are contained within these fences during the pasture phase. The fertilizer regime is based on Phosphorous and Nitrogen with some gypsum and lime applied though not every year. Our soils tend to be duplex in nature –that is, a relatively shallow top soil (4-6 inches) overlaying a clay subsoil. Plants are often able to access moisture requirements from the sub-soil, particularly going into the spring and summer harvest period. Spring varieties are sown in May/June at the beginning of our winter and grow for 5 -6 months until harvest. Harvest is November /December and we usually like to be done by Christmas although this is not always possible. Summer is hot and dry with very little likely hood of rain until the following autumn.

We have very little 'on farm' storage, most of what we harvest goes straight to the elevator from the field, although the trend will be for more grain to be held 'on farm' in the future. A Single Desk selling arrangement exists for that portion of the Australian wheat crop going to export (about 80 per cent). In our state, a Single Desk also exists for the export of Barley. There is much discussion at the moment regarding the merits of the current selling system. The domestic trading of grain is completely deregulated although our domestic market remains relatively small due to a small population and a climate that allows stock to remain outdoors all year round.

Over recent years our Government has pursued a policy of deregulation and corporatisation throughout the economy. The result is that the provision of utilities and services is now the responsibility of private companies. Both the AWB (formally the Australian Wheat Board) and ABB Grain (Formally the Australian Barley Board) are now privatized companies listed on the Australian Stock Exchange with the majority of shareholders being the grain growers of Australia.

Obviously the legislated Single Desk has been compromised somewhat due to it being held and operated by companies which now have obligations to share holders as well as farmers. The current situation is that the Single Desk must maximize returns to those growers who deliver into the Pool, while those who sell grain for cash do so with the understanding that the purchaser is entitled to make a profit from that trade.

In our state the entire elevator system is owned by one company. Formally a grower co-operative which was established to build the elevators in the 1950's and 1960's, SACBH became privatized in 1999 and issued shares to growers relative to their deliveries into the system over the previous ten years. The company became known as AUSBULK and has in turn recently merged with ABB Grain, to become the third largest grain trading and handling entity in the country. This trend towards fewer and larger companies is set to continue as is the trend toward alliances with other companies both within and outside of Australia.

My hometown of Cummins has a population of just 800 people. It is entirely focused on servicing the surrounding farming district. Cummins has a school, hospital and Doctor, aged care facilities, sporting grounds and a range of shops and machinery dealerships.

In the early 1990's, Australia was experiencing a recession and at the same time, significant consolidation was occurring in agriculture and associated industries. This of course effected many small towns including ours, and the most visible sign of this was the withdrawal of banking services to the community. Within eighteen months we went from having three banks in town to none. Since that time we have established a 'Community Bank' whereby the local population are shareholders in their own bank and profits are returned through dividends and through financial support of various local projects.

Land prices have been relatively buoyant lately and the most recent sales in our district have been around $1600 to $1800 per acre. This makes buying farmland as a viable investment in its own right a dubious proposition, but as farmers that is what we do. Those of us who choose to be producers of agricultural produce will continue to do so with slim profit margins.

However, my future is in farming and agriculture as it is for many of you. It is this career path that has led me to being here today talking to producers on the other side of the world. The best thing we can all do going into the future is to be proud of what we do and positive in the way we do it.

Reference

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