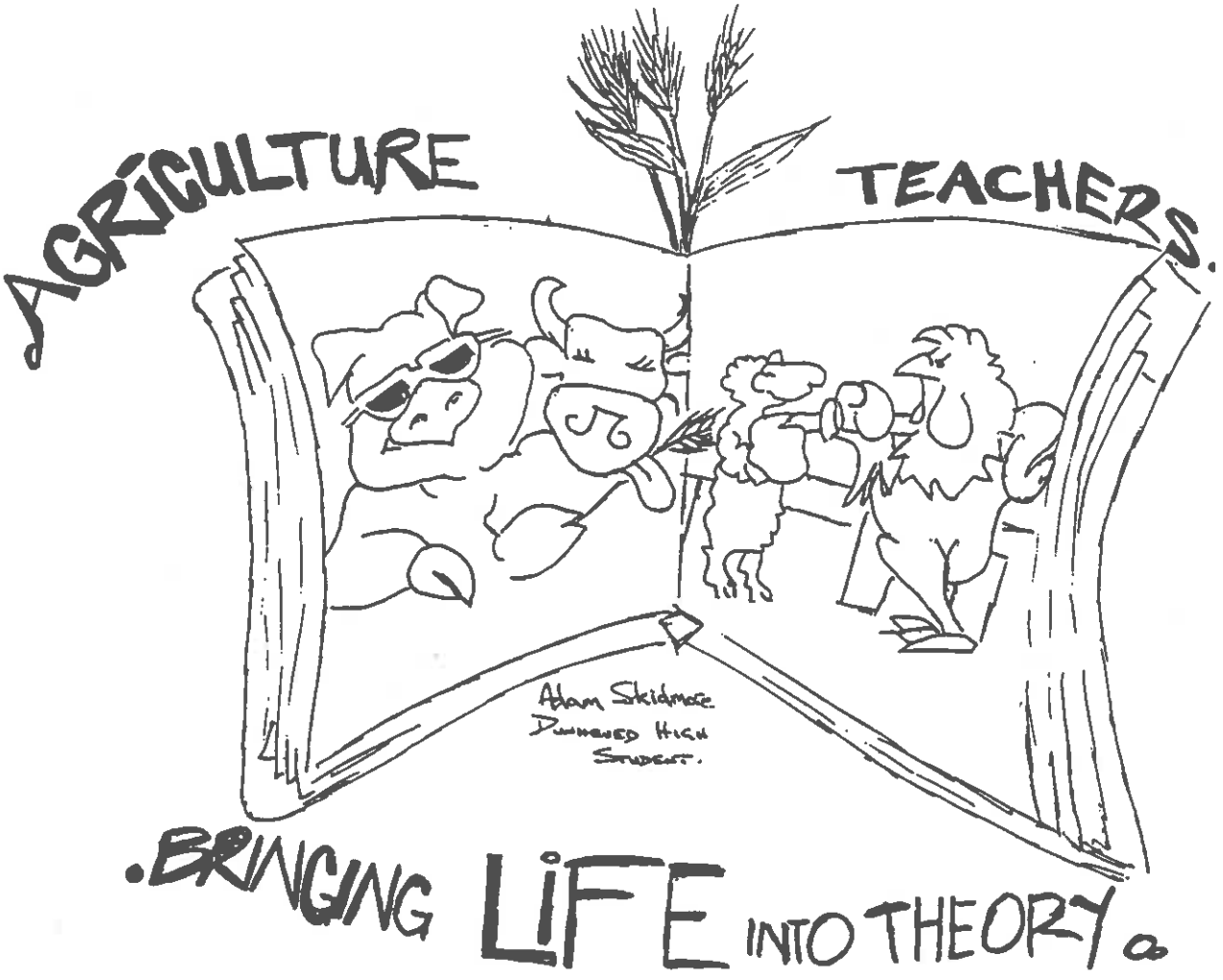
Vicki

B.A.A.T



•BRINGING LIFE INTO THEORY•

Number 1
July 1991

EDITORIAL

Firstly an apology to ALL members who have been patiently waiting for B.A.A.T , delays in production could not be avoided but hopefully the wait will be worth it .
I have contacted a number of sources in an attempt to produce articles which I hope you will find interesting as well as useful . In futur editions I will be adding and developing various segments in an attempt to ensure B.A.A.T becomes an invaluble source for the promotion and enhancement of agricultural education . The areas I refer to ;

* Professional Development
* Focus on Agricultural Education in Schools
* Promotion of Resources and Excursions
* Feedback on Inservices
* Interest Articles

At the end of this edition you will find a feedback page which I hope you will use to provide your thoughts on , this publication , inservicing , ideas for excursions or ideas for articles . Of course there is always a need for material for future publications . A final note about this edition is an explanation about the answers for the 1990 Agriculture paper . Due to restrictions due to copywrite it was impossible to print the answers as well as questions .

Now for some information you might find interesting . There is a strong possibility that there will be a 10 week retraining course offered next year for training agriculture teachers . In the initial planning for this course there has been considerable discussion about offering the course to science trained teachers who are already teaching agriculture as an aid to improve their confidence and skills in the subject area .
There is a substantial inservice in the preliminary planning stages be organised for early 1992 that will be focusing on teaching agriculture into the mid 1990's . The inservice is being organised as a cooperative effort between Met West and Western Region and will be held at Orange Agricultural College . Details will be advertised as they become available .
Finally a comment about the Key Learning Area Technology and Applied Studies and the Design and Technology Syllabus . Firstly it appears many principals (and others) are confusing the Key Learning Area with the Syllabus Design and Technology . It is important that you highlight to these people that the Key Learning area needs to be properly represented in the Junior Curriculm structures and not just as the mandatory Design and Technology . If you DON'T your subject as well as the other subjects in the Key Learning Area are going to suffer when it comes to elective choices in years 9 & 10 .
Also , don't forget the only way that Agriculture will be reflected properly in the Design and Technology Syllabus is for YOU to become totally commited to being involved in its implementation .
Lyndal Foster (Consultant for the Board) and Dianna Wallace (Board Inspector) are excellent sources for inservices dealing with the implementation of the subject . Remember if you don't become involved and commited the the "Nuts & Bolts" boys are going to control the subject in such a way that all other qualified teachers will have little chance to have an input .
Finall some important points relaing to the implementation of the Design

and Technolgy Course .
1. The final syllabus should be released to Schools by October after being approved by the Ministry .
2. The support material document is due to be released (Draft) in September , these materials being produced by the Board .
3. The Board has contracted Joint Council to produce and publish supplementary support material in the form of a teaching kit and these will be available for purchase later this year .
4. The D.A.T.T.A course that has run this year is proving to be an absolute "botch up " with very little in the way of positive outcomes being aschieved . The original course being designed to provide teachers with a way of upskilling and extending their knowledge in the DEsign and Technology . It is clear all that the course has succeeded in doing is to create considerable confusion and extra work load for the participants (at a time they don't need it)

Till the next edition - pleasant reading .

AGRICULTURE - WHERE TO IN THE 1990'S

As Excellence and Equity moves closer to full implemeentation, a number of significant changes need to highlighted which directly and indirectly affect agriculture and agriculture teachers in NSW Secondary Schools.

I will deal with the issues one at a time.

1. The Impact of Design and Technology

The key learning area of Technology and Applied Studies is to undergo considerable change. From 1992 all government schools implement the compulsory Design & Technology syllabus in Year 7 and in Year 8 in 1993. Non-government schools have till 1995. The syllabus is compulsory for all students. consequently the teaching time in Years 7 & 8 is defined in the following way:

Key Learning Area	40 minute period
English	5
Mathematics	5
Science	5
Technology	4
Humans & Environment	4
Creative Arts	4
Languages	2 (4 after 1995)
Sport	3
Religion	1

This pattern fills the week except for 3 - 4 periods. These extra periods can used by the school in any way they feel is appropriate for the school's purpose. e.g. in an Agricultural High School it could be agriculture, in a Technology HS it could be more technology or computers.

The pattern described means no more agriculture as a subject in the traditional smorgasbord years of 7 & 8. Agriculture will remain an elective for Years 9 & 10, as will technics, food management, computing, etc. What happens to your agriculture periods in Years 7 & 8?

If you do nothing they will be lost, as will jobs agriculture teachers. All agriculture teachers need to stand up and be counted - to do this you need to become part of the technology teaching team, teaching the Design & Technology Syllabus.

Let me outline in brief the nature of the Design & Technology Syllabus in Years 7 & 8 by providing some extracts from the draft document.

Any school will need to choose the 'contexts' they will teach from the syllabus. Obviously a school with agriculture and its associated facilities would be silly not to use the school farm as a resource in teaching the Design & Technology Syllabus.

Case A:

2 units English
4 units Maths
4 units Maths
4 units Science (e.g. Phys Chem)
= 10 units
They must do a humanity
+ 2 units
= 12 units
therefore = no technology

Case B:

2 units English
3 units Maths
4 units Science (e.g. Bio, Chem)
= 10 units
They must do a humanity
= 2 units
=11 units
+ 1 unit OAS or General Studies
Therefore no technology

As can be seen, access to technology subjects for the better students is impossible - I would argue this is hardly equity. We have a problem for both the subject and the students.

Over the medium to long term there will be considerable problem for us in the technology subjects - namely the better students not being part of the candidature reduces the total condidate quality, this potentially reduces the mean when scaling occurs, reducing TES of students. As this occurs parents and communities push their children into subjects with perceived higher means (even it they can't do them) - we have the potential for a downward spiral.

Obviously the technology subjects are highly valued and are very appropriate for the large bulk of students doing the HSC. The reality may be that the perceived lower status of the technology subjects may lead to larger term consequences.

I think this issue is important enough to start writing to local members and the board - it is vital if we don't want the subject sector. We need to take positive action.

4. The Senior Syllabus

As with the junior syllabus, the senior syllabus will be provided with outcomes. Because of the relative specificity of the objectives in the syllabus, I don't believe this will have much impact.

The existing syllabus is coming up to 7-8 years old. It is the belief of the committee that the existing syllabus has led to remarkable changes in the way in which agriculture is being taught in schools. It is however in some ways obsolete both in format and in our better understanding of the nature of agriculturals systems. Consequently it will be rewritten as the first priority of the committee.

What is your role? It is not I believe, to just teach the 'context' of agriculture. All technology teachers in the team need to become multi-skilled and teach beyond just their own area - in fact that is the spirit of the syllabus. As agriculture teachers we already have skills in many of the contents e.g. building and structures, food and in many cases others such as information technologies.

The problem we face is that the general perception of principals and others is that the Design & Technology Syllabus is something for the existing faculties of industrial arts and home science. Already in some schools where the draft syllabus has been sent for comment, principals have passed to the above name departments and it has not been seen by the agriculture teachers in the school.

It is imperative that you quickly bring to the attention of your head teachers and principals that you are not only interested in teaching the new Design and Technology Syllabus but that it is required that you be involved as one of the subjects subsumed in the Technology and Applied Studies area.

A State wide inservice program called DATTA and a range of regional based courses in this key learning area are to be held over the next two years. Make sure that you are there!!!

2. The Junior Agriculture Syllabus

You already have performance descriptors for the school certificate. This will be complimented by the syllabus being provided with a set of outcomes. All syllabi are to be written in the form of outcomes. Outcomes will specify knowledge and skills which students should achieve. this will contain more specificity on which to base both teaching programs and Year 10 assesssment.

The syllabus committee under direction of the Board of Studies will develop these outcomes. They would be in schools within 1991. Within the next 2-3 years a brand new syllabus will be written which will further specify outcomes for teaching programmes.

3. The Senior School

In Excellence and Equity a statement is made that for the HSC all students must do English, at least one subject from the areas of Maths, Science and the Technology and at least one subject from the Humanities and Language areas - sounds a reasonable statement.

Further analysis however shows a potentially disastrous problem for the Technology subjects like agriculture - essentially a large group of good students cannot take them anymore!

Analysis shows the following two situations

The committee is looking for ideas about what a new syllabus should be like and what it should include. It invites all agriculture teachers to write, care of the Board with yur ideas and suggestion.

The times are as exciting as they are changing. As agriculture teachers challenges are before us. Don't let them slide by, be there in the forefront to both raise your own professionalism and the impact and status of our subject area.

FROM THE JUNGLE TO THE FARM

By Walter Boles

Few birds are as familiar to so many people as is the domestic fowl or chicken. It is known to have been domesticated in civilisations for more than 4000 years and has since appeared throughout most parts of the globe, including many remote islands and among primitive societies with limited outside contact.

The junglefowls, a distinctive group of pheasants, are the ancestors of the modern domestic fowl. Four distinct species of junglefowl occur through the warmer parts of south-central and southeastern Asia and into Indonesia - Red Junglefowl (Gallus gallus), Ceylon Junglefowl (G. lafayetti), Sonnerat's Junglefowl (G. sonneratti) and Green Junglefowl (G. varius).

There is a close resemblance between the domestic and wild junglefowls. The male, or cock, has a single comb on top of the head and two wattles under the bill. The tail is compressed with two long curving central feathers. These elongated feathers and the strong spur found on the legs of the male are missing in the female.

Wild birds are very timid but have adapted to living near villages despite heavy hunting as a food source or in retribution for their fondness for farmers' grain. The ranges of the four species are generally exclusive except for an overlap between the Red and Green Junglefowls in a small section of Java. Although captive birds freely hybridise, no interbreeding has been reported in the wild.

Most authorities agree that the Red Junglefowl is the ancestor of modern poultry, although some ancestry of the other species has been claimed. The Red Junglefowl is the most widespread of the wild species, occurring from western India through to Indochina, Malaysia, Sumatra, and parts of Java. Its spread from its wild state in its native environment to the domesticated bird found throughout the world has an intriguing history. In addition to providing an interesting puzzle in itself, the study of the development and introduction of the domestic fowl has provided some valuable information towards the understanding of early civilisations and their movements. When attempting to trace the spread of the domestic fowl through history, three major lines of pursuit prove helpful. The uses of and attitudes towards the chicken, its names in the societies, and its physical characteristics are often indicative of the bird's ancestry.

Modern poultry has been selected for its flesh or egg producing quality. Gastronomic considerations, however, have not always been the primary concern. Evidence shows that religious and sporting aspects of the fowl were of far greater importance in early cultures, and its food potential was not developed until much more recently. As cultures spread, some of the customs that moved with them were those relating to the chicken. Therefore, if there were two possible sources of introduction of the fowl to an area, a comparison of the cultural uses often provides a valuable clue to its origin.

Related to the selection for culturally desirable characteristics is the development of distinctive physical traits. Cocks for fighting would have been bred for pugnacious temperament and physical strength, while food birds would have emphasised quality and quantity of meat and eggs. Many early religions required white chickens for sacrifices and thus birds would be chosen for colour. The different physical attributes resulting from this selection can serve to illustrate the lineage of the breeds of poultry. Two major groups of domestic fowl exist - the Mediterranean breeds and the Asiatic breeds. The former are characterised by such traits as large single combs, small bodies, and white egg shells as opposed to pea combs, heavy bodies, and tinted eggs in the latter.

A picture from the tomb of Tutankhamen in Egypt (ca. 1350 BC) illustrates a cock with the characteristic comb of the Mediterranean breeds, suggesting descent from birds originating in northwest India.

A knowledge of the ereditary relationships of the various traits is also useful. The Asian breed character of pea comb is dominant over the single comb of Mediterrranean breeds. If the Asian breeds had reached Europe, the pea comb feature would have eventually replaced the recessive single comb trait. As displacement of single combs did not occur, this may be considered evidence of the absence of Asian Breeds in Europe.

The third valuable source of information on the domestic fowl's dispersal is the linguistic study of its names in different cultures. The greater number of names in use usually indicated increased importance or greater antiquity of the bird in the society. Where the chicken was well established, each sex and age group usually had different titles. East African names for poultry are similar to those used in India; Japanese terms closely resemble those used by the Aztecs and some other Central American societies.

The preceding sources of information and examples demonstrate the process by which the history of the domestic chicken has been traced. Although not all authorities agree on dates and methods of introduction, a generalised summary of the current theories on the dispersal of the domestic fowl can be presented.

The exact date of first domestication is debatable. Fossil and sub-fossil remains of fowl from parts of Europe have been reported, but are considered highly questionable and have not been widely accepted. Most figures forwarded are between 3000 and 4000 BC. Fowl were probably domesticated in India by 3000 BC. Burma has been suggested as the origin of poultry, in which case the initial date could possible be some thousand years prior to its appearance in India.

Documentation for the presence of domestic fowl in the Indus Valley Civilisation places its occurence around 2350 BC. Trading between the Indus Valley and Mesopotamia (ca. 2300 BC) has lead to the suggestion that the chicken reached the Middle East by 2200 BC. Certainly, it was well established soon after. Active sea routes would have resulted in a relatively rapid introduction, although a longer overland path through Afghanistan is a possiblity.

The primary purpose of poultry in Mesopotamia was for sacrifices. The birds were kept in large numbers at temples as festival offerings to the goddess Bau and were referred to in the omen texts. The fowl became an important element in the Zoroastrian religion in Persia and later in Greece and Rome. In the religious literature between 2000 and 700 BC, it was called the 'Herald of the Dawn' and occasionally 'Bird of Light'. It was said that God created the cock to crow, thereby fighting the demons of idleness and the hosts of evil which were harboured by the darkness. Ancient writers such as Virgil and Pliny commented on the attitudes towards crowing, considered in Rome to be a favourable omen. Selection for this habit no doubt occurred and today crowing in domestic birds seems to have no real biological significance. In parts of the Middle East, crowing contests are still held.

Prior to 2000 BC, considerable domestication of other birds - ducks, guinea fowl, and even pelicans - as a source of eggs, had been practiced in Egypt. No evidence of the fowl is found during this period and it was not until the commencement of trading with Mesopotamia that the chicken made its appearance in Egypt. A graffito on the Thebean temple, the first definite evidence, placed the date near 1850 BC. Other unquestionable illustrations of cocks were found on the tombs of Rekhmara (ca. 1500 BC) and Tutankhumen (ca. 1350 BC), discussed earlier.

Under the leadership and miltary prowess of Thutmosis III of the XVIII Dynasty (1504 - 1450 BC), Egypt's borders reached their greatest extent. Among the tribute received from conquered countries were four birds. It is described in the Royal annals carved in stone on the walls of the Great Temple of Karnak that "they bring forth every day", i.e. they lay eggs every day. This capacity for increased productivity in egg-laying is a selected characteristic in domestic birds not found in their wild ancestors. It is agreed that this reference is to the domestic fowl. The name of the source of the tribute was broken from the wall, but from a reading of the remainder of the text, this has been shown to be between Syria and Babylon.

A major subject controversy was the 'chick hieroglyph', a frequently inscribed figure in tombs, which, if it was indeed a young fowl, would have placed the arrival of poultry in Egypt before 4000 BC. Many interesting theories about the symbol's identity were put forth. One author suggested it represented a now extinct flightless partridge formerly endemic to Egypt. Others considered a very early introduction (ca. 4600 BC) of the fowl by Mesopotamian invaders (an invasion for which no other evidence has been found) to be the explanation, or that religious and/or aethestic sanctions on picturing the adult allowed only the chick which was "elegant and pleasant in appearance" to be shown. It has now been concluded that the hieroglyph, which remained unchanged from dynasty to dynasty, represented the appropriately named Pharoah's Quail *Coturnix coturnix*. Two statuettes of a wattled bird from 4400 BC are almost certainly guinea fowl.

Other notable Egyptian findings featuring the chicken are a description in the "hymn of the Sun" inscribed in the tomb of Ay (ca. 1355 BC) and a slilver bowl originating during the reign of

Seti II (1200 - 1194 BC). The five centuries following Seti II saw a decline in external contact with an accompanying recession in trade. No mention or traces of the fowl have been discovered in this period.

Soon after the fowl had reached Egypt it had also appeared in Crete (ca. 1550 BC) by way of Mesopotamia. It may have been known in Italy at this time but as nothing more than an object of curiosity. Despite the proximity of Crete, it was not until 800 BC that pictures of the fowl appeared in Greece. A jasper seal from a grave in Tharros illustrating a man, a lotus plant, and a cock, and a coin from the Temple of Artemis at Ephesus with a cock imprinted have been found. Both date from ca. 700 BC. By 600 BC, fowl were commonly represented in Grecian art.

The failure of the Old Testament to speak of fowl has led some authors to conclude that the bird was absent in Palestine during this time. They fix the time of its introduction in the second century BC. Recent archeological excavations near Jerusalem, however, have revealed pieces of pottery with figures of both male and female fowl. A double spur in one picture suggests an emphasis on the fighting abilities of the bird. Cocks are shown on two seals from Jerusalem (ca. 587 BC), one for Yaazanjahu 'the Servant of the King', and one for Yaachzjuhn, 'the Son of the King'. Chickens were not used as food and one authority attributes this reluctance to the bird's position as a sacrifical object in Persia at the time.

Following the Persian conquest of Egypt in 525-524 BC, the fowl once again became an important part of the culture. A seal showing a hen defending her chicks and clay vessels in the form of cocks are among the variety of ways this bird was incorporated into the art. In the Greek and Phoenician colonies around the mouth of the Nile, it was a favourite subject of artists in their terracotta work.

By 200 BC, poultry had assumed a very significant role in Roman life. Although Pliny, Varro and other later writers praised the fighting abilities, it was in Rome that husbandry of the fowl reached its highly complex level. Specialised breeds and rules for their care were developed. Within the vast poulty indutry that grew, specialist branches were formed and details of economic problems outlined. Ancient scribes' descriptions portray stocks similar to those of present day and as equally prolific as egg layers. Chickens formed a conspicuous part of the Roman diet. Possibly the best known reference at this time is the Biblical narrative of the cock crowing thrice following Peter's denial of Christ.

Several pathways of introduction into Europe are currently accepted. One is that from Egypt to Crete and from there to Greece and Italy. Another is a route through eastern and central Europe, eventually converging with the first introduction in northwest Europe. when the Romans invaded Europe, they discovered fowl as part of the Celtic society in 100 BC and in Britain in 43 BC. In Cornwall and Scotland, legends suggest that the Phoenicians brought the birds, which if true, raises the possibility of the existence of a sea route.

With the fall of the Roman Empire, the chicken's importance diminished. It was raised for food on a farm to farm basis but did not reach the magnitude that it had earlier. The breeds were genetically strong, however, and were thus maintained with little conscious effort. No large scale resumption of the industry was made until the nineteenth century.

In the opposite direction of the Middle East and European introduction, domestic fowl were transported from India to the Orient. Domestication of poultry in China was practiced by 1400 BC, primarily for religious and fighting purposes. During the Chou Dynasty, 11th to 3rd Centuries BC, chickens were used for sacrifices. Although the record is not as well documented as the westward dispersal, it is known that the fowl was introduced to most east Asian societies and the development of the Asian breeds began.

The nearest relatives of a breed found in East Africa seem to be those in India, which is consistent with the idea of a direct introduction by sea.

The role of European explorers in the arrival of fowl in the New World was debated for many years. Had Spanish introductions been the initial ones or were earlier trans-Pacific ones responsible? Cabral brought cickens to Brazil in 1500 AD. Nineteen years later, Magellan found 1000 miles to the south of their original landing spot. Within forty years, they were present over most of South America. These stocks were well differentiated from European breeds. Poultry were important in the lives of most South American tribes, yet no Spanish names were in use.

The argument of pre-Columbian versus post-Columbian chickens was carefully researched by George F. Carter. Comparing the rates of diffusion in the Old World with those implied by the post-Columbian concept, he showed that in the New World this rate would hae to be higher by several orders of magnitude. Setting the value to that of the Middle East, he arrived at a figure of 1500 BC.

Using the methods of study discussed earlier, Carter found information consistent with that from his diffusion rate study. American birds had pea combs and other Asian traits unknown to Europeans. Tribes seldom ate the birds or eggs, instead valuing for their fighting and decoration; again, an Asian-like, non-European pattern. Perhaps the linguistic aspect is the most revealing. Non-Spanish names were used even for Spanish birds. It was also found in the Philipppines the the older name remained in use to the exclusion of the those introduced by a new culture. Throughout the New World, the names were of Asian origin; different ones seemed most closely related to Indian, Chinese or Japanese.

From this Carter concluded that although the Spanish brought some fowl, multiple Asian introductions from several sources were of far greater significance. Trade between Asia and tribes on the coasts of Peru and Ecuador was of greatest importance. Carter also suggests that Central America at the time of the Aztecs was visited by early Japanese, although this theory is not widely accepted.

The journey to South American shores must have been from the Asian mainland or large offshore islands. Little appears to have been transmitted by way of the intervening Polynesian islands, for establishment of poultry in Polynesia did not occur until relatively recently - ca. 1300 AD. The distribution of chickens throughout Polynesia is patchy; they appear on some islands but are absent on others. On those islands to which they were introduced attitudes and uses of poultry followed the general Asian pattern, although with individual variation. The differences in stocks throughout Polynesia suggests multiple introductions. In Hawaii, white chickens were important in necromancy. An Ancient Tahitian legend tells that chickens have been there as long as man. Henhouses for sacrifical fowl have been found on Easter Island. European explorers reported poultry on Bougainville, new Hebrides, and several other islands.

Australia stands out as somewhat of an anomaly. No evidence of pre-European fowl have thus far been found despite numerous potential sources.

With few exceptions, every recent society has come into contact with the domestic fowl in one context or another. Regardless of the purpose to which it is put, the chicken should continue as the most important bird ever domesticated by man.

FURTHER READING

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AGRICULTURE

Question 1.

a) i) Variability of income over time. Variability of income with enterprise.

ii) Fluctuating incomes resulted in difficulties in long term planning, which resulted in personal stress.

iii) 1. Export markets - increased demand results in an increase in price of product: increased income
2. Climate - e.g. droughts leading to loss of production and therefore reduced income.

iv) Explanation of at least 2 of the following (i) diversification (ii) off farm investments (iii) insurance (iv) avoiding risky enterprises etc. (v) contracting to ensure fixed returns.

b) An example of a management practice which improved efficiency e.g. introduce irrigation system, use of proven AI sines etc. OR diversification to smooth income fluctuations.

c) i) Financial data preferred - fixed and variable costs, total revenue, profit. Production data was relucantly accepted.

ii) Calculation of profit by subtracting fixed and variable costs from the total revenue. A comparison with other farms helps show a farmer's financial position in the industry.

d) Land. Competition is handled by sales to the highest bidders within the constraints of zoning regulations as imposed by Government bodies.

e) i) Carbon dioxide - land clearing reduces photosynthetic material therefore leading to increased CO2. Combustion of fossil fuels in farm machinery - increased CO2 Methane - ruminant biproduct.

ii) Increased CO2 can cause increased photosynthetic rate and therefore increased plant production/growth, provided no other limiting factors.

Question 2.

(a) ii) (a) There is a decline in yield in both varieties as sowing time gets later. (b) The decline is greater in A, B being a more consistent yield.

iii) It is very useful to find at which variety has the highest yield at different sowing times and/or when to sow a particular variety.

(b) i) The legume crop would improve soil fertility (nitrogen content) in the soil. No crops grown consecutively - breaks disease cycle and reduces nutrient depletion.

ii) Use of fertilizers, use of higher yielding variety of cereals, irrigate crop and increase sowing rate.

(c) i) 1. a) increased organic matter results in increased microbe activity and improved soil structure. b) 2. increase in plant material on soil leads to reduced erosion and increased water holding ability and nutrient level in soil.

ii) Residue can harbour pests and diseases which could reinfect next crop. The breakdown of residue decreases soil pH and available Nitrogen and this could reduce germination and plant growth.

iii) Beneficial: plough residue in, increasing the rate of breakdown which improves soil structure and rate of nutrient recycling. Undesirable: Use crop rotation and resistant varieties to break disease cycle. Apply nitrogen and/or lime to and microbe activity and raise pH.

(d) i) Production of pollen-pollination, translocation of nutrients from general plant growth to seed growth and fruit development.

ii) A: Growth Plants need photsynthesis to grow. Optimum levels of all inputs woudl lead to max. growth, however if there is a factor limiting such as water, light etc, the rate of photosynthesis declines and effects growth.
B: Time of Flowering Flowering time is a response to some stimuli. It is usually daylength or temperature Chrysanthemums flower as the period of darkness increases.

Question 3.

(a) i) Predators reproduce and therefore build up in numbers when food (pests) is readily available.

ii) Favourable environment (large food supply). Favourable climate or seasonal conditions.

iii) Pest exceeds economic threshold. Damage to crop warrants cost of control.

iv) Build-up of pesticide resistance in the pest population making control less effective in future. Predators would also be eliminated allowing pest populations to recover quickly.

v) Both pest and predator will suffer initial reduction in numbers, followed by an increase in pest numbers with predator lagging behind.

vi) Biological control - using a natural predator to control pest numbers.

(b)

i) Sterile males of Screw-worm flies are released. These sterile males compete with wild males for the females and thus reduce success of reproduction.

ii) Control organism turns to destruction of non-harmful or productive species - may become a pest and breed in large numbers.

(c) i) Yes! As a reduced L.A.I. results in reduced photosynthetic capacity leading to reduced yield.

ii) Variety B is a cultivar bred to be genetically resistant to the disease.

iii) No! Hybrid vigour is reduced in subsequent generations and uniformity of the crop is lost resulting in lower yield.

Question 4.

(a) i) The estimated additional pasture is double the pasture produced under dryland conditions.

ii) i) Late spring/summers are hot and dry leading to evapotranspiration exceeding water applications resulting in reduced pasture growth. ii) Winter temperatures drop below the lower critical limit for pasture growth resulting in reduced pasture growth. iii) Increased temperatures in spring lead to increased pasture production.

(b) i) i) Supplementary (grain, pellets, concentrates)
ii) Reduce stock numbers in winter
iii) Conserve fodder (hay, silage, haylage)

ii) Gather information on variable costs under each option and subtract from total income to work out gross margins. Compare gross margins for best option.

(c) Water availability limits vegetative phase of dryland pasture causing it to mature earlier than irrigated pature that does not have water as a limiting factor.

(d) i) May-June Oct./Nov. Jan.-Feb.

ii) i) May-June: flock requirements relatively high indicating "steaming up" (flushing) for mating. ii) Oct-Nov.: flock requirements steadily increasing (consistent with last 1/3 pregnancy) and lactation after parturition. iii) Jan.-Feb.: flock requirements decrease as lambs weaned and ewes stop lactating.

(e) i) (i) Costs of installing and running irrigation (ii) Extra returns as a result of increased production.

ii) A comparison using gross margins (variable costs from total income) for irrigation and non-irrigated pastures to see which has the greatest profitability.

iii) (i) Cost of installation and maintenance. (ii) Affect on soil i.e. erosion, salinity, soil structure decline. (iii) Ability to manage irrigation system.

(f) The legume would fix nitrogen as a result of the symbiotic relationship with rhizabium. The extra nitrogen would be utilised by the grass thereby

increasing pasture production in the grazing system.

Question 5.

(a) i) Soil compaction reduces seedling emergence and poor water infiltration reducing plant growth.

ii) Cultivating in wet conditions reduces soil structure as the soil particles will stick (cement) together. Double cropping involves more cultivation which increases the load on the soil, leading to > compaction

iii) No, as sand has high drainage as particles do not stick together (poor cohesion)

iv) Minimum tillage methods and crop rotation, these both maintain structure and organic matter content of soils.

(b) i) Red podzolic - physical good water holding capacity, A horizon good structure - chemical down profile decreasing acidity, high C.E.G.

ii) Crop/Pasture rotation involving legumes will add nitrogen therefore increased fertility and, O.M. and pasture phase will maintain stability and reduce erosion.

(c) i) Sowing Shearing

ii) Sowing - sowing after rain to ensure germination. Shearing - farmers are unable to shear if wool is wet as shearers won't shear.

(d) Dairy Disease

i) Mastitis causes the milk to be unsaleable and so production and profits decrease.

ii) The farmer 'strips' milks and quarantines the animal and adds antibiotic e.g. penicillin

iii) Better prepared by therefore improved hygiene e.g. dipping teats in iodine, cleaning machinery as this reduces the spread and growth of bacteria.

Question 6.

(a) i) density the mortality, ^ her weight ^ egg production, weight ^ mortality

ii) Breed, Age, Length of trial, climate, Housing, Quality of feed, Health of bird, Economics

iii) Increase or decrease in F.C.R. would require the farmer to check efficiency of the system.

iv) Ruminants - 4 stomachs, convert low quality roughage slowly via microbial action to necessary proteins and vitamins. Monogastrics - High quality supplied proteins, CHO etc.

v) Market preferences, supply and demand of product. Utilisation of land as a cheap resource in grazing.

(b) i) Welfare issues, economic efficiency, quality control, disease management, labour component.

ii) Stability of prices, stability of supply, marketing efficiency through advertising and creation of new markets, quality control.

(c) i) ^ infiltrations rates, ^ microbial and invertebrate activity, ^ O.M. content, ^ soil structure, retention of nutrients (slow release)

ii) decomposition
ammonification
nitrification
mineralisation
cation exchange

Ever since man first domesticated animals he has sought to improve their suitability for his own use. He has done this by breeding and selection procedures based on an intuitive understanding of the genetic principle that "like begets like". The range of animals that he has developed for food, for clothing, for traction, for companionship, for hunting and so forth have all come about without him having any knowledge of the molecular basis of heredity or any knowledge of the structure and function of the gene.

This startling accomplishment is a tribute to the perceptiveness of connoisseurs of animal breeding who, by observing the outcome of their strategies of selection and mating, developed an empirical understanding of the processes of genetic selection.

Even when certain aspects of heredity were described in Mendelian terms, it was not possible to develop economically useful characteristics in animals by qualitative selection procedures, except in a very few instances. Most of the sought after traits were obviously controlled by many genes so that progress in improving the capacity of animals to produce milk, meat or fibre was very slow. The introduction of concepts of performance and progeny testing and quantitative selection procedures gave some prospect of additional progress but cumulative gains in productivity could only be a few percent in each generation and were limited by the physiological capacity of the animals to cope with the particular exigencies of the environments in which they lived.

The constraints imposed by the Mendelian laws of inheritance meant that genetic selection was rather like a game of poker, in which the pack of cards comprised the complement of genes that made up the species. A new animal carried the hand of genes that was dealt when the pack was shuffled at mating; only by discarding some cards, retaining others and reassorting them into different hands could the selection process be directed towards a particular outcome. The more genes one sought to select the less likely they were to appear in the hand that was dealt. And so for thousands of years, the genetic constitution of animals has been altered by man using techniques which are constrained by the generation time of the species, by the constitution of the natural gene pool and by his inability to predict how a particular gene will be expressed phenotypically.

Recently it has become possible to conceive that these constraints on the improvement of farm animals imposed by the laws of Mendelian inheritance might be bypassed. This has come about through the discovery of the molecular basis of inheritance, through an understanding of the hormonal control of the reproductive cycle, through developments in techniques for manipulating sperm, eggs and embryos outside the body and through discoveries in genetic engineering. Although these discoveries must still be seen to be at a quite primitive stage of development, it is not very difficult to envisage the extent to which research in the next 10 years will transform our capacity to manipulate the genetic constitution of animals directly by processes that could be described as "human direction" as distinct from "natural selection".

The Genetic Significance of the Male

Although the genetic constitution of every individual is derived equally from each parent conventional methods of genetic selection have given the male an overwhelming significance in breed improvement programmes. The capacity of the male to generate vast numbers of germ cells allows the genetic attributes of an individual male to be incorporated much more rapidly into a population than the attributes of a female. Techniques for collecting and storing semen from farm animals have been well-established and in commercial use for 30 years or so. The exploitation of these techniques has meant that one male could sire thousands of offspring over a period that extended way beyond his own life-time. The development of national artificial insemination programmes and services has transformed the productivity of the dairy industries in a way that has produced embarrassing surpluses of dairy products in many countries even though national inventories of dairy cattle have been substantially reduced.

The use of artificial insemination techniques in animal breeding does have, however, another greater potential for improving livestock populations. The sex of an embryo is determined by the sex of the sperm. Sperm carrying the X or the Y sex chromosome produce either a female or a male embryo when they fertilise an egg. If it were possible to separate sperm on the basis of these sex chromosomes offspring of either sex could be produced to specification. So far this has not been accomplished but it is now known that there are specific antigenic molecules expressed in a sex-linked way on the surface of cells. These HY antigens are present on the surface of the sperm and they may provide a means of separating sperm into male and female populations. New techniques exist for the production of monoclonal antibodies which can be used as specific probes for identifying surface antigens. These antibodies can be complexed to fluorescent molecules and this may enable cells to be sorted on the basis of their surface antigenic makeup.

The Genetic Significance of the Female

The female produces only a limited number of egg cells during her reproductive life and in farm animals such as the cow, ewe and mare only 10 or so eggs are fertilised to produce offspring during a life time. For this reason the genetic significance of the female, in a population sense, is quite small relative to the male.

There are several new prospects for increasing the influence of the female on the genetic structure of animal populations, through techniques for controlling and regulating the oestrus cycle and through the harvesting and storage of eggs and embryos in much the same way as sperm are collected and stored. It is possible to stimulate the development of eggs in the ovaries of sexually immature animals and have them ovulate precociously. In this way the reproductive life of the female can be initiated long before natural puberty occurs. Calves only a few weeks old treated with gonadotrophic hormones will produce eggs; these eggs are mature and can be fertilised and the resulting embryos either stored frozen or transplanted into surrogate mothers. This gives a reproductive potential to females far in excess of their physiologically determined productive life and with these techniques a calf could produce, in a genetic sense, a hundred or more offspring before it was 12 months of age.

In cattle and other species, lactation inhibits the production of eggs and cows suckling calves have a prolonged period of anoestrus. It may become possible to establish pregnancies early after parturition by inhibiting the production, at least temporarily, of those hormones which prevent the development of new follicles during lactation. This may be possible to achieve by the use of specific antibodies or by injections of steroid or gonadotrophic hormones.

Embryo Transplantation

It is now common practice to control eostrus and ovulation in cattle by treatment with various hormones. Prostaglandins are used to destroy the corpus luteum and synchronise oestrus in cattle so that artificial insemination programmes can be done much more easily. Pituitary hormones are used to produce multiple ovulations. The crops of eggs can be fertilised by artificial insemination and recovered from the cow. These embryos can be transplanted into surrogate mothers or stored frozen in liquid N_2 for later use. Already there is an international commerce in cattle embryos which has made traditional concepts of animal quarantine and transportation obsolete.

Embryo transplantation offers a means for rapidly expanding genetic material of meritorious females through the use of animals of lesser breeding worth. Multiple conceptions can be produced by the implantation of several embryos. It is possible by surgical manipulation to divide embryos into pieces and produce identical twins, triplets or even higher multiplicities of pregnancy. These genetically identical offspring can be produced by the same mother or by surrogate mothers; they can be of the same age or they can be of different ages depending on whether or not the sectioned embryos are all transplanted together or whether some are stored in a state of suspended animation prior to transplantation. The fusion of embryos together and the injection of cells from one developing embryo into another has been done to produce synthetic animals with genetic constitutions derived from 2 fathers and 2 mothers of chimaeric animals comprised of populations of genetically different cells.

In future it is likely that animals will be produced by asexual or vetetative means using somatic cell nuclei transplanted into enucleated eggs. These techniques when perfected will make it possible to produce multiple facsimile copies or clones of any individual animal. These cloned individuals will be of a preordained sex and it will be possible to derive them from sexually incompetent animals. The champion steer will then become the champion sire of the year.

Genetic Engineering

The primary constraint in all genetic selection procedures up until now has been that imposed by the compendium of genes that are naturally present in an animal population. The livestock producer has had to work with the genetic material that nature provides and he is restricted to rearranging this genetic material into its most felicitous combinations by repetitive matings and selection of offspring. There has never been, up until very recently, any prospect of manipulating the genes of animals directly or of adding foreign genes from one species to another to create a new species. Now, however, prospects exist for bypassing the entire Mendelian process

by laboratory manipulations. We now know the basis of the genetic code and how this code specifies the constitution of an amino acid and where a particular amino acid is to be placed within a chain to produce a particular protein molecule. It is now possible to isolate and sequence the nucleotides that make up a gene and to define in precise chemical terms the differences between genes. Genes can be divided into pieces and reassembled to make new genes so that the geneticist of the future will no longer need to be content with the genes that nature has furnished - he will be able to make his own. There still remains the difficulty of knowing what a given gene will do when it is incorporated into an animal, for at the moment we know nothing of the biochemical or physiological steps that determine the phenotypic expression of a gene. At this time we can only test the effects of a gene in a living system. As yet we have no idea how to construct genes that will lead, for example, to increased milk production or to tick resistance or, for that matter, how to construct a gene that will produce a red or a white coat colour.

But recent experiments have demonstrated that there are possible ways of identifying genes which can improve productivity in farm animals and of incorporating them into new individuals. Further, it now seems likely that these new genes incorporated artifically into a developing embryo, will enter germ line cells and be transmitted sexually to subsequent generations. Already a gene coding for the production of growth hormone in the rat has been introduced into mice. The expression of this gene in terms of growth hormone production in the mouse has created a new species of giant mouse that grows at a much faster rate and reaches a much greater mature size than a normal mouse. And so the future offers the incredible prospect of man being able to create new species of animals by design; animals which could never occur by any natural processes.

While the techniques of genetic engineering will enable genes to be maniuplated <u>in vitro</u>, the gene is only a chemical entity which has to be introduced into the nucleus of a cell and incorporated into its life processes. At the level of a single cell in tissue culture the incorporation of a gene into a cell nucleus was perhaps not too tall an order for we have known how to grow mammalian cells in tissue culture for something like 100 years. The genetic engineer has devised ways of attaching genes to carrier structures such as plasmids and phage viruses which can enter cells and take with them the new gene. There is, however, an enormous difference between a transmogrified cell in tissue culture and a fully differentiated individual. It has always been a daunting prospect to take a transformed cell in tissue culture and have it and its progeny incorporated into the some of a complete individual. The extraordinary thing is that the technology to do this has been developed at the same time as the techniques of genetic engineering have been discovered. We now know how to incorporate alien cells into blastycysts and how to have these cells grow and express their genetic potentialities in an individual.

It may be that further discoveries in the fundamental biology of cells will enable us to produce sex cells in culture from somatic tissue cells. To do this tissue cells would have to be induced to undergo meiotic division to reduce their chromosome complement to the haploid number. These cells could then be fused with an egg or another haploid cell in much the same way as sperm and egg cells fuse at fertilisation to form a zygote. With this technique the genetic selection of animals could be done in tissue culture

and individual genes selected by specific probes in each generation of cells. The generation time of cells in culture is only a matter of hours and it is not hard to envisage the advantages such methods would give. The selection process would be done in generations of cells rather than in generations of animals.

In the book of Genesis there is a vivid description of God's wrathful visitation on man through the great flood. Noah and his family were instructed to build an ark of gopher wood 300 cubits long, 50 cubits wide and 30 cubits high and to take into this ark a sexual pair of all the animals that existed on the earth together with enough food to preserve them from the flood and to keep their seed alive on the face of the earth. How different an ark will be in the future should it be required to do the same job.

DEVELOPMENTAL PLANNING FOR AGRICULTURAL PLOTS

AN EXAMPLE DEVELOPED BY INSERVICE PARTICIPANTS FROM MET. WEST REGION .

Plan based on simulation workshop case study . REMEMBER much of the following process can be used to evaluate existing agricultural plots .

STEP 1 . The Evaluative Process

* Develop a student profile and carry out a needs analysis .

* Assess the site - Size , topography , soils , water , drainage, general capabilities of site .

* Assess your skills and interests .

* Evaluate existing programs , evaluate future cuuriculum directions , check syllabus requirements .

* Assess the communities attitudes towards your proposals , invite input (financial help might follow) , assess attitude of school executive and ascertain future directions for school.

* Be aware of the schools priorities and mission statement , remember your proposals should reflect the priorities of the school and community .

* Assess your potential market .

* Establish your financial needs , timelines and possible sources of funds .

* Seek consultation from region , other schools and community .

* Seek help from properties regarding capital developments .

* Analyse personnel availability .

STEP 2. Management Plan Development

* Outlining short on long term goals .

* Years to be taught .

* Staffing

* Curriculum development timeline

* Funding sources

* Enterprises to be developed , including timeline of implementation and need .

* Assessment of priority and practicality .

STEP 3 The Implementation

Remember vegetable growing enterprises should be established first as they provide maximum involvement for students , minimise financial outlay and optimise some form of financial return .

Animal enterprises are normally more expensive to initiate and only give a small number of students involvement , poultry would however be the exception .

Don't forget what ever you start needs to be able to be taken over by another teacher if you leave . Also be aware that some teachers lack expertise .

STEP 4. Evaluate .

Continually evaluate your management plan taking into careful consideration changing community and student needs , finance , changing cuuriculum and school priorities .

A AIM.THIS UNIT OF WORK IS DESIGNED TO ACT AS A STUDY GUIDE FOR THE STUDY OF ANIMAL REPRODUCTION ,PART OF THE ANIMAL PRODUCTION SYSTEM.TO COMPLETE THIS UNIT SATISFACTORILY YOU MUST ,READ THIS UNIT THOROUGHLY ,SEEK OUT THE SELECTED RESEARCH TEXTS, AND COMPLETE THE STUDY GUIDE QUESTIONS.

UNIT-ANIMAL REPRODUCTION

ANIMAL	BEST TIME TO BREED	LENGTH OF OESTROUS CYCLE	LENGTH OF HEAT	TIME OF OVULATION	GESTATION LENGTH
SHEEP (ewe)	Autumn	17 days	1.5 days	End of heat	147 days
CATTLE (cow)	All year	20 days	18 hours	12 hours after heat	283 days
PIGS (sow)	All year	21 days	2 days	End of heat	117 days
HORSES (mare)	Spring	21 days	1-20 days	1 day before end of heat	342 days

ANATOMY OF THE SYSTEM

THE FEMALE REPRODUCTIVE SYSTEM

The organs of this system are the ovaries ,oviducts ,uterus ,cervix ,vagina & vulva.

The ovaries

These are paired organs, which in the non-pregnant female are usually located in the pelvic cavity .They are oval shaped and about 2cm in the ewe and 4cm in the cow.

The ovaries serve two very important functions.They contain the ova, one or several of which ripen and are released at the appropriate time during the reproductive cycle. They also act as endochrine glands , that is an organ that produces hormones (oestrogen & progesterone) which affect the behaviour of the female and cause changes in the other reproductive organs.

The oviducts or fallopian tubes

When the ova leave the ovary they enter the oviducts.These are paired tubes with expanded open ends lying close to the ovary on either side.Each oviduct is about 25cm in length and terminates at the uterus.

If the female has been mated at the appropriate time , sperm will have made their way into the oviducts and here the union of the sperm and ovum will result in fertilization and the start of the development of the embryo.

During passage through the oviduct ,towards the uterus , (about three to five days), the embryo grows via cell division to the 32 or 64 cell stage.

The uterus

In ruminants the uterus is 'Y' shaped , consisting of 2 horns converging on a body . Each horn commences as a continuation of an oviduct .

By the time the embryo reaches the uterus , hormones from the ovary will have prepared the uterine wall for pregnancy . The wall will have become very vascular and glands are formed which actively secrete "uterine milk" which nourishes the embryo until the placenta is formed , about two weeks after conception in the ewe and five weeks in the cow .

The placenta is formed by fusion of the outer fluid filled membrane and raised vascular structures on the uterine wall called cotyledons.

The placenta then acts as a transfer zone for nutrients , oxygen , carbon dioxide and waste products.

3The terminal part of the uterus projects slightly into the vagina and is called the cervix . This has a thickened ring of muscle and keeps the outlet of the uterus closed until the time of birth . When the time comes for the foetus to be born the muscles of the cervix relax . There is a contraction of the muscles of the uterus proper , and of the muscles of the abdominal wall, which causes the foetus and its enveloping membranes to be expelled through the vagina to the exterior.

The vagina and vulva

The vagina is about 8cm in length in the ewe and about 25 to 30 cm in length in the cow . It terminates at the exterior at the vulva, the external part to the female reproductive tract .During oestrus the male semen can be introduced through the vagina directly into the uterus , because the muscle of the cervix relaxes also during oestrus.

THE MALE REPRODUCTIVE SYSTEM

The organs of this system are the testes ,epididymus ,vas deferens ,urethra, penis and associated glands .

The testes

These are paired organs which normally lie in separate compartments of the scrotum. They have corresponding functions to that of the ovaries of the female, that is , they produce the male sex cell (sperm) as well as generate the male sex hormone ,testosterone.The sperm are formed by the specialised cells,known as the seminiferous tubules, first by a mitotic and then a meiotic cell divisions.As the sperm are formed they move through the a system of conducting vessels and then eventually they enter the epididymus.

The scrotum

This is a very important organ as it regulates the temperature of the testes,an essential act as it determines they activity and life span of the forming sperm.When the external temperature of the scrotum is cool , the muscles of the scrotum contract and hence draw the testes closer to the bodies warmth . This action ensures that the sperm have maximum chance at survival and further ensures that they mature at the correct rate (an essential factor in determining effectivness of sperm).When external temperatures are excessively warm the scrotal muscles relax and hence allow they testes to move away from the body and at the same time alloe the exposure of a large surface area to cooling air currents.

The epididymus and vas deferens

Associated with each testis is a system of tubes leading to the urethra . The epididymus lies against the outer surface of the testis , and consists of a long , fine tube which forms a coiled mass at both the upper and lower poles of the testis.As the sperm pass through the epididymus they undergo further development and maturation .

Each epididymus terminates at the vas deferens, this organ is a relatively thick walled tube that passes out of the scrotum into the pelvic cavity . It terminates by entering into the urethra . Close to the urethra the vas deferens has an expanded portion in which the sperm accumulate .

The male accessory glands

There are three glands that contribute to the fluid component of semen (known as semina! fluid) . They are seminal vesicles ,the prostrate gland , and the bulbo-urethral glands . Their secretions enter the urethra on ejaculation and serve to nourish and activate the sperm as well as provide a liquid medium for the movement of the sperm.

The urethra

This is a hollow tube which extends from from the urinary bladder in the pelvic cavity , through the penis to the exterior. The penis contains cavernous tissue which ,under stimulus of mating becomes engorged with blood causing erection of the penis.

In the ram or the bull the penis has an 'S' shaped flexure which becomes straightened on erection , causing protusion of the penis.

When the erect penis enters the vagina at mating , contraction of the accessory glands and the vas deferens forces the semen through the urethra. This is called ejaculation , and if mating is to be successful some of the semen must pass through the cervix into the uterus .

REFER TO THE DIAGRAMS IN THE APPENDIX OF THIS DOCUMENT FOR DIAGRAMS OF THE RESPECTIVE REPRODUCTIVE TRACTS .

HORMONES AND THEIR AFFECT ON THE THE REPRODUCTIVE SYSTEMS

HORMONES OF THE FEMALE REPRODUCTIVE CYCLE

The female reproductive cycle is controlled by a number of hormones which are released in turn by a series of glands known as endochrine glands . The glands involved are the anterior & posterior pituitary glands , the hypothalmus and the ovaries .

Hormones of the anterior pituitary gland

FOLLICLE STIMULATING HORMONE (FSH) The function of this hormone is to stimulate the development of the follicles in the ovary . A secondary function of this hormone is associated with the follicle development , that is the production of the hormone oestrogen . As the follicle developes the level of oestrogen being released by the ovary increases (this continues until ovulation takes place .

LUTEINISING HORMONE (LH) LH in the presence of FSH acts to stimulate the developing follicles to mature and when there sufficient levels of oestrogen present rupture of the follicle takes place (this event being known as ovulation) . The presence of LH also initiates the formation of the corpus luteum which in turns generates the hormone progesterone (the corpus luteum is the structure that forms at the site of the ruptured follicle).

LACTOGENIC HORMONE (PROLACTIN) This hormone is extremely important as it stimulates the secretion of milk by the cells in the mammary gland .

Hormones of the posterior pituitary gland

OXYTOCIN This hormone is extremely important to the process known as milk let-down .. Without the correct stimulation of the udder this hormone will not be released and hence the alveoli of the mammary gland will not contract to force the milk into the gland cisterns . Thus if the young or the dairyman will not be able to get the milk .

Hormones of the ovary

OESTROGEN This hormone is one of the most important in the female system . Its initial function is its affect on creating female characteristics e.g. mammary development , pelvic structure , female shape and fat and muscle formation . Oestrogen also stimulates growth of the vaginal wall, retention of water in the reproductive system and the formation of mucus by the cervix and uterus . Finally it is oestrogen that stimulates signs of oestrus ,courting behaviour and makes the female readily accept mounting by the male.

PROGESTERONE This hormone is not only produced by the ovary but also by the placenta . This has a variety of functions namely it stimulates the development of the uterine wall ,it causes thickening of the cervical fluids ,it maintains pregnancy , inhibits FSH production and in the case of cattle and sheep conditions the animal to respond to oestrogen (refer to latter notes on oestrus synchronization) .

RELAXIN This hormone is vital to ensure ease of birth as it is this hormone that causes the pelvic ligaments to relax at birth .

THE HORMONES OF THE MALE

There are two extemely important hormones of the male reproductive system , one known as testosterone (an androgen) released by the interstitial cells of the testes and ICSH (interstitial cell stimulating hormone -the same as LH) which is released by the anterior pituitary gland .

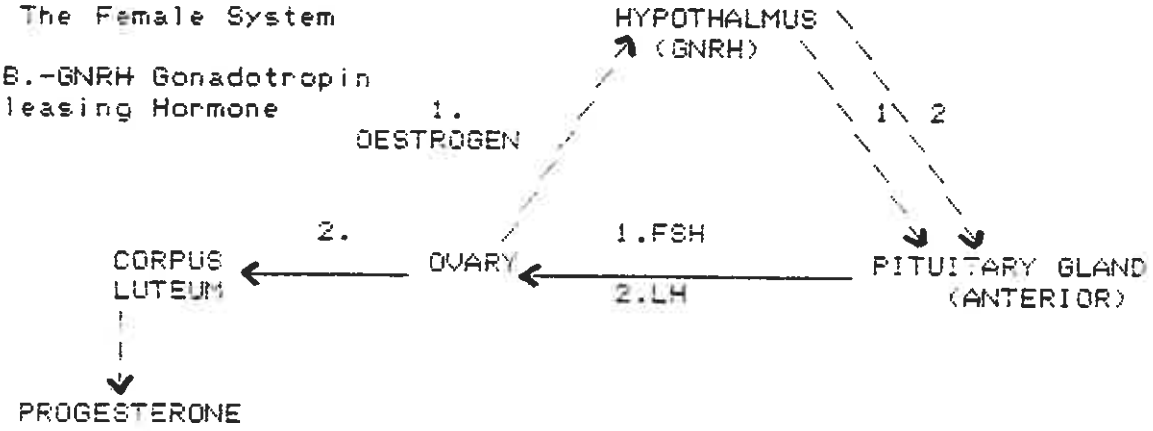
ICSH The function of this hormone is to stimulate the interstitial cells to release the hormone testosterone.

TESTOSTERONE This hormone has many functions namely ; the formation of sperm ,to promote growth and development of the accessory sexual organs e.g. the epididymus , influences aggressive libido of males , influences secondary sex characteristics (maleness) and icreases protein retention particularly in the form of skeletal muscle .

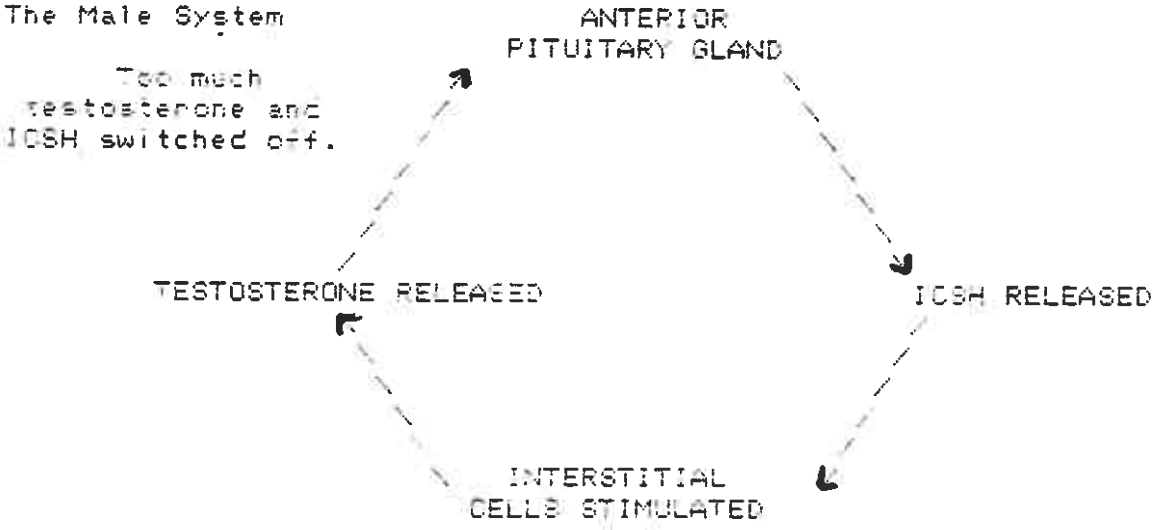
THE HORMONE FEEDBACK SYSTEMS

a) The Female System

N.B.-GNRH Gonadotropin Releasing Hormone



b) The Male System



FACTORS AFFECTING REPRODUCTION

When dealing with the factors that affect reproduction the list created is immense but on further examination this list can be classified into five major catagories ; namely nutritional , genetic , disease , climate & managerial factors .

DISEASE

Disease can affect reproductive performance through three major avenues , these being venereal diseases ,nutritional diseases & parasitic infestations.

Venereal diseases

The most important of these diseases are ; Brucellosis , Vibrosis , Leptospirosis , Toxoplasmosis , Listerosis & Trichomonasis .
The following is a table that summarises the features of some of these diseases.

VENEREAL DISEASES OF AUSTRALIAN LIVESTOCK

DISEASE	CLINICAL FEATURES	ABORTION RATE	TIME OF ABORTION	METHOD OF DIAGNOSIS	DIAGNOSIS	CONTROL
Brucellosis	Abortions Orchitis	Up to 90%	6 months + (cattle)	Ingestion Venereal	Blood Test	Destroy infected stock
Vibrosis	Infertile stock Irregular cycles	Low 5-20%	5 months (cattle)	Venereal	Vaginal mucous test	2 herd system A.I. vaccine
Lepto-spirosis	Abortion associated with illness Known as 'REDWATER'	Moderate 25-50%	6 months + (cattle)	Through skin Ingestion	Blood Test	Vaccine

CASE STUDY OF A VENEREAL DISEASE

Brucellosis - Other names , Contagious abortion & Bang's disease .

Causal organism (Bacteria) - Cattle - Brucella abortus
Sheep- Brucella ovis
Pigs- Brucella suis
Goats- Brucella melitensis

The disease - Up to the point that the animal reaches sexual maturity there appears to be a degree of natural immunity to this disease . Once sexual maturity is reached no animal has immunity to invasion by the causal organisms . The symptoms of the disease are abortions of foetuses late in gestation , abnormal swellings of knee joints & swelling of the epididymus in males . The disease is most commonly spread by by ingestion of contaminated pasture (contaminated with the after birth of an aborted foetus). It may also be spread via males in the herd mating with clean females after mating with diseased ones as well as contaminated material being flicked onto clean animals via the tails of contaminated ones . It is important to note that this organism is viable on a pasture up to 100 days in winter and 30 days in summer . Once the organism has invaded the animal it circulates in the blood stream until it localises itself in the uterus,udder,lymph glands or in the synovial joints . This means treatment of the infected animal is impossible . To prevent the disease a national

erradication scheme is running whereby all animals are tested and all reactors are destroyed. The other important feature of this disease is that is zoonotic (that is transmisable to humans) .

Nutritional diseases that affect fertility

The nutritional diseases are many and varied but two very important ones are ; Hypocalcaemia & Subterranean clover disease (oestrogenic pastures).

Hypocalcaemia -

Symptoms- Prevalent in ewes in lamb especially if grazing on green oats . They move with a stilted gait at first and then develop a stagger . They eventually go down and drag along on their hindquarters , death can result in 24 hours . Immediate action is to give an injection with calcium borogluconate which will have the animal back on its feet in 1/2 an hour. Prevention is via close observation of ewes diet to ensure Ca+2 defeciency does not take place also to ensure animals do not become stressed .

Clover disease-

Symptoms- Causes the birth of dead or very weak lambs with many ewes unable to even give birth . The lambs decompose in the uterus thus leading to a cystic condition in the uterus . Affected ewes become sterile leading to lower reproductive rates.Casterated males can come into milk and also have swelling under tails because of formation of false bladder .

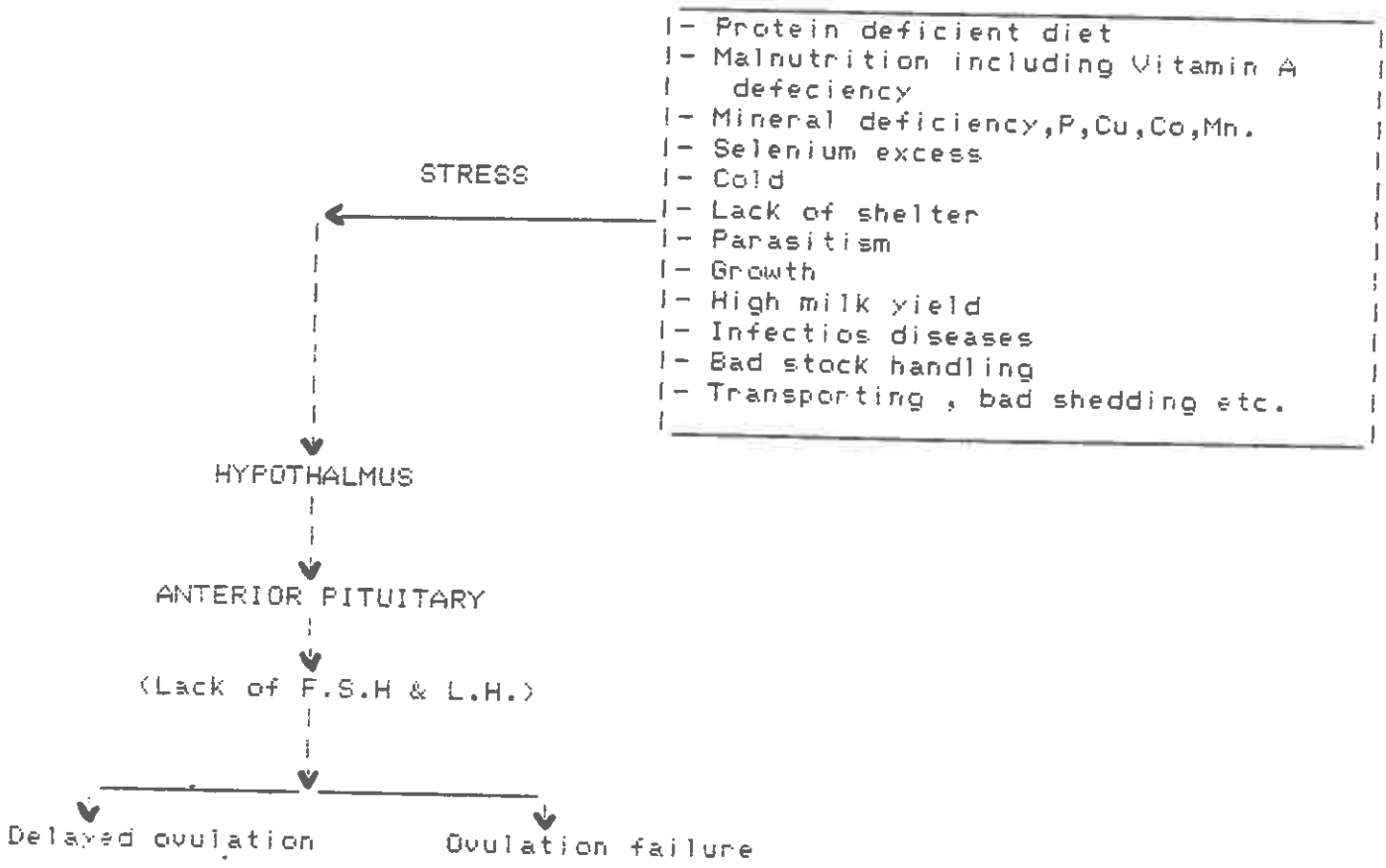
Treatment - None except the removal of stock from suspect clover pastures and the re-establishment of pastures with oestrogen free cultivars of sub-clover.

CLIMATE

Climate has some significant affects on the reproductive performance of livestock ,the most obvious of these are the indirect affects of climate on feed availablity . Climate can also affect reproduction through things like stress due to excessively high temperatures , dehydration of newly born livestock , abnormal foetus formation due to very high temperatures , severe affects on quanitity and quality of semen due to high temperatures & excessive losses of newly born lvestock due to exposure (mainly on wet ,cold , windy nights) .

STRESS

Stress is a very important factor in the determination of reproductive capabilities of livestock . The important thing is that management & good nutrition both ensure minimisation of stress . The following flow diagram will demonstrate how stress affects reproductive performance .



NUTRITION

As alredy indicated nutrition is critical to avoid stressing the animal and to prevent problems from occurring in the last third of pregnancy .
This last third of pregnancy is critical as two thirds of the foetusses growth takes place during this period , thus incorrect feeding during this time can affect reproductive performance drastically ;
-too much feed can result in overfat mothers and very large young resulting in a large amount of dystocia .
-too little feed can result in weak young , pregnancy toxaemia , and hypocalcaemia .
-feeding during this period of time also determines the length an quality of the following lactation.
The nutrition of the animal can also be used to manipulate the reproductive performance of the female ;
-the placing of females on a higher plane of nutrition 6 weeks before mating (given the term flushing) increases the rate of ovulation (in sheep this can result in a 10-20% increase in lamb numbers)
-the placing of young female stock on a lower protein diet can delay the onset of sexual maturity and thus make the animal a more suitable breeder .

GENETICS

This will be followed up later in futher topics suffice to say that genetics can have two affects on reproduction . Firstly it can greatly improve reproductive rate through the inducement of hybrid vigour (e.g the use of first cross ewes in fat lamb raising) and secondly it can result in a nett decrease in reproduction because of inbreeding (recessive lethal genes show up).

MANAGEMENT

To fully cover the role of the manager it is necessary to fill in the following table after appropraite discussions in class .

CONDITION	DESCRIPTION	AFFECT ON REPRODUCTION
1.Sudden changes in feed/or climate		
2.Low quality pasture		
3.Prolonged overfeeding		
4.Abnomalities of testes		
5.Lameness		
6.Low and high ram or bull %		
7.Flushing		
8.Age		
9.High plane of nutrition when young		
10.Culling %		

11.Mating time

12.Mating period

13.Mixing ages of females

14.Shedding rams for very long periods

15. Stress

16. Using P.M.S. on livestock.

17.Selecting on reproductive performance

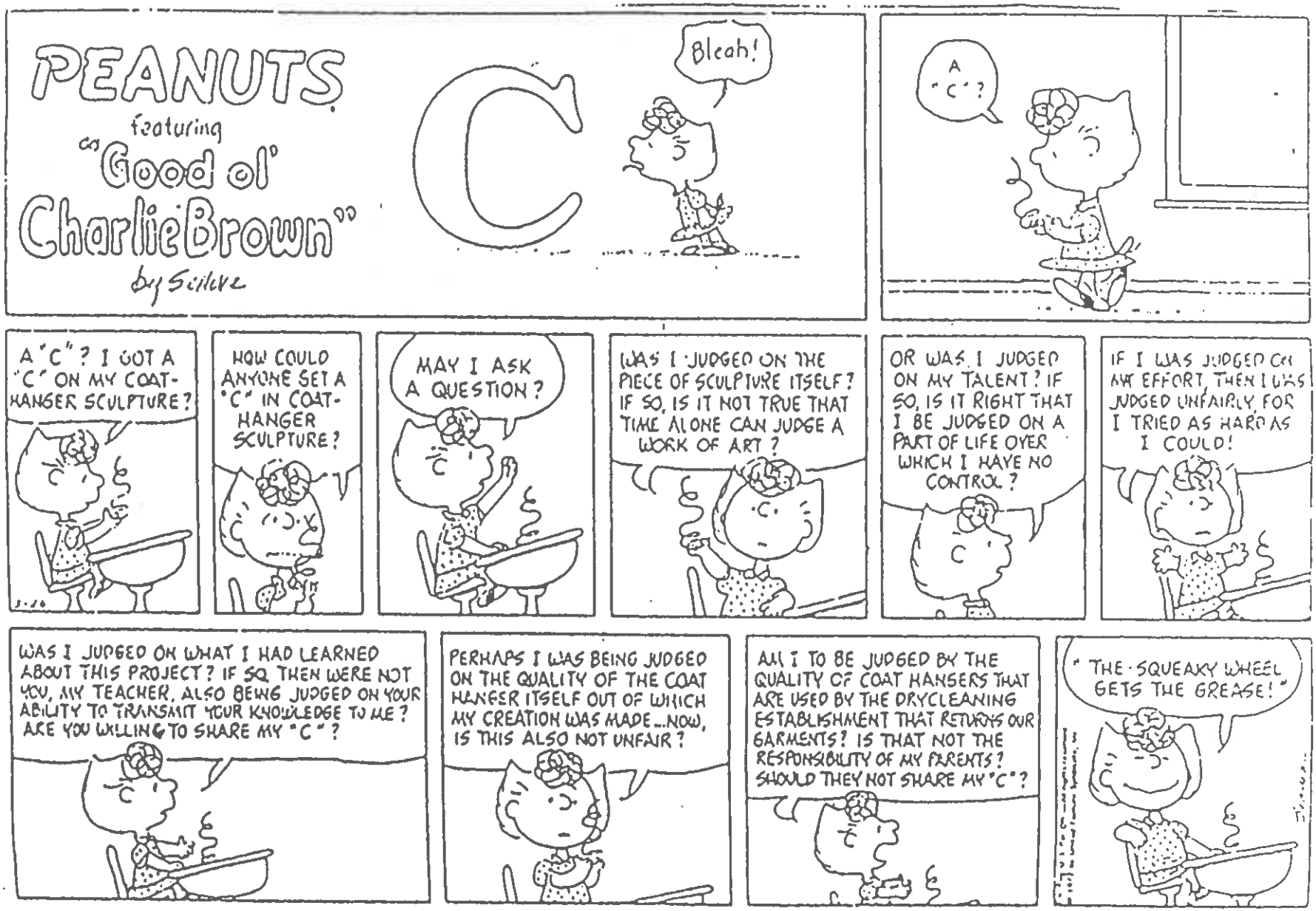
18.Using progesterone tampons on females

19.Using teaser animals around stock in season.

20.Breeding at a too early age.

QUESTIONS FOR RESEARCH AND SUBMISSION

Question 1. Outline some of the current advances in reproductive techniques that allow maximum genetic potential of any animal to be fully utilised .
Question 2. Outline the research findings of the following people or establishments and indicate the importance of their work to the overall improvement of reproduction of animals in Australia.
Question 3. What advantages are there in crossbreeding animals ? Outline the use of this principle in two industries .
Question 4. Describe the reproductive system of a chicken . How does it differ from a mammalian reproductive system ?
Question 5. What is dystocia ? What factors increase the chance of dystocia taking place ?
Question 6. Outline the hormonal control of reproduction in animals .
Question 7. Describe three diseases that affect the reproductive capabilities of animals and indicate how they can be managed.
Question 8. Explain management practises which can improve the reproductive capabilities of livestock .
Question 9. Discuss the possible causes of male infertility and indicate how these problems can be managed .
Question 10. Neo-natal mortality is a major source of wasteage in the sheep industry . Discuss the major reasons for heavy lamb losses . Indicate management strategies that could be used to minimise losses .



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Assessment Strategies for Year 10

As Schulz indicated in his cartoon strip " Peanuts " the concepts associated with assessment are complex . The complexities of assessment are brushed over by many of us , but since the implementation od descriptors for Year 10 there has been an awakening to the need for an evaluation of the way we assess and how we use the information gathered .
Take a close look at the extracts from the junior syllabus , Dunheved High's method of setting tasks and recording information , as well as the practicals designed at a recent Met West inservice and use this information to reflect on what YOU are doing .
Please give me your ideas and examples of assessment tasks as then we might be able to develop a portfolio for other Ag Teachers .

EXTRACTS FROM SYLLABUS (JUNIOR)

The purpose of assessment is to produce accurate information about what the students can do, and in particular, to establish what progress they have made towards achieving the aim of the course.

The use to which assessment information will be put varies. Sometimes it is used mainly to guide the teacher and student in working out how best to proceed - what learning experiences it seems sensible to plan next, what remediation is necessary before the next planned task can be confidently attempted. At other times it is used to report achievement to parents and other proper audiences.

Both the purpose and the intended audience will influence the kinds of achievement assessed and the manner in which the resulting information is reported. In some cases, it will be more helpful to provide a description of what the students have achieved, perhaps by a profile showing how the student has fared on a set of important skills, than a single mark or grade which seeks to compare the student's overall achievement with that or other students.

The information on which the assessment is based should always reflect achievements which students have demonstrated. Though the onus is on the students to provide evidence of their achievements, it is on teachers to ensure that the students have proper opportunities to produce the evidence. Written tests, for example, are useful measuring instruments to the extent that they provide these opportunities, but they are only one means among many of collecting useful information.

ASSESSMENT ITEMS

Before commencing any form of planning for the development of assessment tasks it is essential that you critically appraise a number of areas ;

* What are you attempting to achieve with your assessment ?

* What types of assessment are you going to use ?

* What aspects of student achievement will be assessed using these methods ?

* Do your assessment tasks relate to your program ?

* Are your assessment tasks realistic and valid ?

Types of assessment task and the areas of student achievement assessed .

PRACTICAL TESTS

Thes are primarily designed to assess specific skills under a highly controlled environment .

Examples ;

- Aural skills (following spoken instructions
- Livestock handling
- Identification exercises - weeds
  - breeds
  - tools
  - soils analysis
  - vegetative features
  - disease symptoms
- Demonstration of specific skills - moving stock
  - plant and animal husbandry
  - soil testing
  - diluting chemicals
- Observational skills - Animal behaviour

PRACTICAL ASSESSMENT TASKS

These are tasks primarily designed to assess students skills in the areas of experimental method .

Specifically targeting skills associated with experimental method .

- Experiment design

- Recording data
- Presenting data
- Interpreting data
- Drawing conclusions
- Hypothesizing
- Biometric Skills
- Simple numeric calculations

Some ideas
Interpreting graphs
Feed conversion analysis
Microscope observations , labelling , drawing , scales
Soil analysis
Using keys
Designing a trial
Interpreting written articles
Performing chemical tests
Experimental procedures
Dissections / identification
Evaluation of materials
Correlating and interpreting experimental data .

TESTS

These assessment items are primarily designed to assess thinking skills and if designed correctly are very efficient modes for interpreting student achievement , program efficiency , delivery mechanisms and clinical diagnosis of student need .

Tests are assessing writing skills as well as the thinking skills ; - recall
- comprehension
- processing
- evaluative

ASSIGNMENTS AND ORAL TASKS

This is an area that is seldom used because of feelings associated with ;
- collaboration
- time
- difficulty in marking
- problems with information availability

BUT

This area of assessment can be the most exciting and interesting for teachers and students alike if items are well planned and implemented .
Areas of assessment include ;
Information skills - Developing arguements
- Discussing contraversial issues

- Reasoning skills
- Researching Skills
- Decoding skills
- Literacy skills
- Oral and aural skills

Examples of oral and aural skills

- Impromtu speeches
- Five minute prepared speeches
- Assignment viva sessions
- Debating Sessions
- Oral questioning based around practical activity .

DUNHEVED AGRICULTURE FACULTY

STUDENT PROFILE

The aim of this document is to assess the level of attainment students have achieved in various prescribed skills areas. Assessment is based on ipsative strategies, that is assessing in terms of overall improvement of each individual student.

The advantages of this system are;

- its diagnostic use in evaluating student weaknesses.
- its evaluative use in regard to teaching methodology and program structure.
- its usefulness in establishing student achievement for Course Performance Descriptors.
- it passes on useful information to other teachers.

The disadvantages of this system are;

- the initial planning and development of recording systems.
- the designing of assessable tasks is more involved.
- marking and recording initial takes longer.
- it requires a re-think about classroom organisation, assessment, and teacher roles in the classroom.

1. Teacher needs to become a facilitator in information.
2. Classroom strategies go from teacher centred to child centred.
3. Peer assessment tasks could become important tool.
4. Negotiation of goals for educational outcomes.

NOTE - A complete and rapid change in classroom, teacher and student educational strategies is not essential for the effective use of student profiles but ultimately that should be looked at and acted upon.

DUNHEVED AGRICULTURE FACULTY

STUDENT PROFILE

This document is designed as a diagnostic tool to assess levels of attainment with regard to certain skills as indicated in the Junior Agricultural Syllabus (1983).

The areas of the syllabus to be used in assessment

1. Principles of animal and plant production systems.
2. Historical and socio-economic importance of agriculture.
3. Environmental significance of agriculture and agricultural operations.
4. Principles of Experimention.
5. Future significance of agriculture.

STUDENT NAME: _____

YEAR _____ CLASS _____

TEACHER _____

DATE	TASK DESCRIPTION	MARK IF APPLICABLE

STUDENT NAME _____ PAGE No. _____

SKILL AREA	DATE OF ENTRY	COMMENTS RELATING TO SKILL/TASK AND LEVELS OF ATTAINMENT
Thinking Skills (Knowledge and Understanding) Levels of attainment. Recall, Comprehension Processing Information, Evaluative Skills.		
Experimentation - Can follow instructions - Collect data - Recording data - Design and Conduct Experiments - Interpret Results - Compile Results - Understands the importance of Replication, Randomisation - Simple Biometric Skills		
Practical Skills - Observational skills - Performance of husbandry tasks - Recognition of normal and non-normal behaviour - Problem Solving Skills. - Handle correctly - Handle safely - Monitor animals - Reasoning Skills.		
Written Skills - Use appropriate terms - Researching capabilities - Short/Long Responses - Structure of written responses - Ability to develop arguments and discuss		
Oral/Aural Skills - Follow spoken instructions		

SKILL AREA	DATE OF ENTRY	COMMENTS RELATING TO SKILL/TASK AND LEVELS OF ATTAINMENT
Oral/Aural Skills (Continued) - Answers using appropriate term - Delivery Skills - Transmission of ideas - Presenting a point of view - Asking questions - Narrative Skills		
Possible Oral Tasks - Group Discussion - Viva - Discussion - Seminars / Impromptu Speeches		

THE KEYS TO MAKING PROFILES WORK

1. Plan the tasks you intend to assess well ensuring,
   - they are meaningful.
   - relate to the syllabus.
   - are discriminating.
   - enable the assessment of different levels of achievement easily.
   - that the students see them as being meaningful and helpful.
   - that some positive, for the student, can be achieved by completing the task.

2. Keep your profile records up-to-date and with you all the time.

3. Remember that the majority of assessment will be descriptive and non-numeric.

4. Realise that they can be linked with a standare mumeric recording systems.

ASSIGNMENT NO.1

The following assignment is designed to assess your information gathering and writing skills .

MARKING SCALE

1. Quality and accuracy of information	/ 15
2. Quality and extent of research	/ 15
3. Presentation oof bibliography	/ 10
4. Writing Skills	/ 10
5. Viva at completion of assignment	/ 25
Total	/ 75

Read all sections of this assignment carefully and answer ONLY in the spaces provided .

TOPIC

The raising of pigs for the pork and bacon industries is becoming one of the most technologically advanced agricultural industries in Australia . Using your information gathering and processing skills complete the following focus questions directed towards this topic .

Describe a typical intensive piggery that would be found in NSW and compare it to average type of piggery that you would have found twenty years ago . (Include information like , size , capital , housing , feeding mechanisms , production husbandry , litter sizes .]

References used

Answer

Draw a simple black box model of a pig production system and indicate three inputs , three outputs and five processes of this system .

Select any two of the following topics and discuss how they have improved the efficiency and welfare of the animals in the piggery .

a) CALM marketing
b) Climate contol
c) Genetic improvement and testing
d) Early weaning of piglets
e) Nutritional research

Bibliography

VIVA QUESTIONS FOR THE END OF THE ASSIGNMENT

1. Describe the processes you used to find the information you needed for this assignment .

2. Study the following exert from a bibliography .

Reid R.L. (ed) 1981 . A Manual of Australian Agriculture (4th ed) Heinemann ,Melbourne .

What do the following tell you ;
Point to various aspects of the reference and get the student to indicate the importance of that item e.g. Year

3. For your answer to section 3 , give me a brief summary of your findings .

4. Study the following passage - can you give me the important points of the passage .

ASSIGNMENT 2 - CONTRAVERSIAL ISSUES

The aim of this assignment is for you to demonstrate your ability to assess and discuss articles on issues of importance to agriculture .

MARKING SCALE

1. Quality of summary	/ 20
2. Quality of discussion	/ 20
3. Literacy skills	/ 10
4. Oral presentation to class	/ 25
Total	/ 75

Read the articles provided that include materials from both aspects of animal welfare as well as animal codes of practice . Then using these articles as a reference present your point of view on the humane use of animals .

WORKSHOP

Working in groups of 3 design an assessment task that could be used to assess in the areas of , practical assessment or assignment .

Type of Practical Task _____

Duration for Task _____

Equipment or Special Reqirements _____

_____

_____

_____

Areas of Student Achievement Being Assessed

_____

_____

_____

_____

THE ANIMAL WELFARE DEBATE

Bruce M Brown
Meat & Livestock Secretary,
The Livestock And Grain Producers'
Association of NSW

INTRODUCTION

At the outset, it has to be emphasised that the animal welfare debate is not a new threat which poses problems for modern agriculture. In 1964, the publication of Ruth Harrison's book "Animal Machines", raised many issues on animal welfare which created controversy in Europe and also the U.S.A. However, it was not until the publication of Peter Singer's book entitled "Animal Liberation – Towards an End to Man's Inhumanity to Animals", in 1978, that the animal welfare debate reached any significant level in Australia. Since then, cries for animal welfare and animal liberation, while gathering momentum, have often come from well meaning but often uninformed bodies claiming to view intensive livestock production from the animal's viewpoint, and claiming concern for the welfare of animals. It is important to emphasise that animal welfare, while it is a frequently used term, is seldom understood.

Many critics of intensive livestock production and husbandry practices sub-consciously identify themselves with the animal. Many people consider that since they would not like to reside in a cage, or in a farrowing crate, or in a cattle feedlot, animals would also find this a depressing environment. The danger of anthropomorphism (giving human attributes to animals), is ever present in assessing animal welfare.

To date, much of the argument by both primary producers and animal welfare organisations has been subjective and there has been frequent confusion between fact and opinion. In addition, much of the argument can also be regarded as irrelevant. For example, to suggest that "animals look happy" is an entirely subjective statement which is not based on any scientific premise.

Agriculture is essentially the exploitation of both plants and animals for man's benefit. The decisions as to whether or not we exploit them and if we do, to what extent we exploit them, are in the final analysis, ethical decisions. They are, therefore, decisions that should be made by society as a whole, and not by one small sector of it, such as vegetarians, livestock producers, or indeed, agricultural scientists. However, scientists can be of great help in the welfare debate; their role would be to produce scientific evidence on animal welfare levels, and certainly not to make moral or ethical judgements.

The Philosophy of the Animal Welfare Movement

The philosophical base of the animal liberation and animal welfare movement is a concept called "speciesism". This term is described in Peter Singer's book "... as a prejudice or attitude of bias towards the interests of members of one's own species and against those of members of other species". Man is, therefore, the "speciesist" animal in the case of livestock production in agriculture. The logical extension of speciesism is the avoidance of the consumption of animal by-products such as milk, cheese, butter, eggs and leather products. Singer also suggests "... the principle of equal consideration of animals requires us to be vegetarians". Thus, if members of animal welfare societies support the concept of speciesism, their underlying aim is to convert Australia into a vegetarian society, one which they see as ideal. However, this vegetarian theme cannot be overplayed since despite Singer's philosophical comments, many members of the animal welfare movement are not vegetarians. This in itself must provide these individuals with some fundamentally conflicting matters of conscience.

It has to be emphasised that the concept of "speciesism" is not without its shortcomings, since it completely ignores the basic evolutionary processes. Animals higher up the evolutionary tree have always exploited lesser species; this is a fundamental fact in the evolutionary process. Singer completely ignores the dangers of anthropomorphism and the principle of the equal consideration of human and non-human species is an underlying theme throughout his text. I would imagine the existence of carnivores presenting animal welfarists with a difficult theoretical problem.

The arguments which animal welfarists have attempted to use in attacking intensive livestock production practices are at this point in time, entirely subjective. Indeed, Singer is no exception, as he makes absolutely no attempt to define what he means by "animal welfare" and the lack of objectivity in respect of this issue is apparent throughout his publication. Singer also suggests that ignorance of the nature of non-human animals allows livestock producers to brush off criticism by saying "... that after all, they are not human". On the contrary, it is the person who has no understanding of agriculture and animal husbandry practices, who is readily susceptible to the ideals and ideas of animal liberation and the lack of objectivity in Singer's book. Livestock producers are the first to realise that animals exhibit a complex social structure, recognising and relating to other members of the flock or herd. They realise that an obvious need exists to maintain these social structures that form an inherent part of the animal's welfare.

Another underlying theme in Singer's book is that his case against the exploitation of farm animals is based on the premise that the production of meat is wasteful. Several times he makes the point that grain used in animal production processes could be used to greater effect elsewhere in the world, allaying starvation and under-nutrition in less developed countries. Now, while there is some evidence to support Singer's premise he completely ignores the fact that effective demand for grain products produced by commercial agriculture might not exist. In addition, he ignores

the fact that cattle and sheep are ruminant animals; their greatest advantage is that they convert sometimes otherwise useless plant material into protein. There are vast areas of the world which would prove useless for agriculture except for the fact that rangeland grazing by ruminants utilises plant materials which would otherwise be wasted. In this context, Singer's comments that "this inefficiency of meat production means those who eat meat are responsible for the indirect destruction of at least 10 times as many plants as vegetarians", can only be described as irrelevant. In addition, he fails to state that many crop residues can be only effectively utilised by livestock.

Unfortunately, while Singer places great faith in the findings of the Brambell Committee (British Government Select Committee), there was very little scientific evidence, particularly behavioural evidence, available to this particular committee, and thus many of their recommendations must be treated as arbitrary. In fact, some methods of assessing animal welfare were only initiated after the publication of the Brambell Report. In their report, the committee stated that "welfare is a wide term that embraces both the physical and mental well-being of the animal. Any attempt to evaluate welfare, therefore, should take into account the scientific evidence available concerning the feelings of animals that can be derived from their structure and functions and also from their behaviour".

The final comments from "Animal Liberation" are worth noting when Singer states:

"Throughout this book; I have relied on rational argument. Unless you can refute the central argument of this book, you must now recognise that speciesism is wrong, and this means that, if you take morality seriously, you must try to eliminate speciesist practices from your own life and oppose them elsewhere. Otherwise, no basis remains from which you can, without hypocrisy, criticise racism or sexism".

The undertone of his logic is that all arguments defending current livestock practices and the use of animals in research programmes, etc., are fallacious. He suggests that people would never entertain such fallacies, were it not an attempt to justify their dietary preferences.

A Discussion and Definition of Animal Welfare

What then does the term "animal welfare" really mean? Basically we are talking about physical and mental welfare. Defining the physical welfare or well-being of an animal is relatively easy. Animals should be free from disease, injury, pain, hunger, thirst and parasites. However, the latter side of welfare, that of mental welfare, is more difficult to define and also to quantify. Basically the question is whether animals experience the same feelings as humans do. It is here that the danger of antropomorphism reaches its highest point. It is wrong to subjectively attribute human feelings and mental experiences to animals, and this is the trap into which Singer and other animal welfarists have fallen. An animal's perception of its environment is totally different to the one humans perceive through their senses. Obviously, there is a great difference between the senses and mental capacity of animals in comparison to humans. The question is ... can animals experience happiness, boredom, fear and misery etc.? The Brambell Report suggests that at some level, they can. The complexities of producing objective scientific data in the area of mental welfare are obvious, and of course, to provide objective data in this area, we have to be able to measure it. Such measurements would enable us to set standards and to make comparisons of welfare levels, given that animals are subjected to a variety of environments. A vast body of factual data is available and is being continually expanded on the requirements of animals in terms of nutrition, optimum population densities, temperature, humidity and other welfare criteria. This then, is the scientific data which should be used as a basis for an animal welfare index. In developing such an index, consideration must be given to all factors, including psychological, pathological, biochemical, behavioural and productivity criteria.

Thus we can see that the issue of animal welfare is a complex one. There are no easily obtainable answers, no simple solutions. Decisions as to where to draw the line between what is and what is not acceptable in terms of animal welfare will not be easy to make.

Now perhaps, we are in a situation of attempting to define "animal welfare". Any definitions of this term cannot be absolute, as scientists hold differing opinions. However, "on a general level, it is a state of complete mental and physical health, where the animal is in a state of harmony with its environment".

Given the nature of this paper, consideration cannot be given to all the factors which form part of an animal welfare index. However, there are intrinsic dangers in using productivity criteria as the sole gauge of animal welfare, as suggested in studies of poultry by Bryant (1972), Murphy (1978) and others. For example, liveweight gained may in some cases be related to boredom, anxiety for depression. This is not to suggest, however, that productivity criteria should not be used to assist in the construction of an index of animal welfare.

Can Objectivity be Achieved?

There is broad agreement on the need for legislation on health, veterinary and animal welfare standards. Such legislation safeguards the consumer in that animal products are fit for human consumption and animals utilised in this process are afforded a level of protection compatible with minimum welfare standards.

All possible efforts must be made to ensure that governments have considered all the objective scientific data available to them before existing animal welfare legislation is changed or new legislation introduced.

The standards set down in the legislation will probably depend on the balance of power among political parties and the lobbying power and electoral appeal of both primary producer and animal welfare organisations. While it is normal for these factors to play an important role in the legislative process it has to be stressed that the actions of the parties submitting recommendations in the period during the drafting of the legislation will have a major impact on the standards set down by the legislation.

This is illustrated in the following table which sets out minimum standards in respect to hen area in battery production systems for a number of European nations:

Minimum Hen Area (cm^2) Country/Region	Min Hen Area (cm^2)	Comparative Index
Lower Saxony	400	100
Sweden	480	120
U.K.	500	125
Denmark[1]	600 (900)[2]	150 (225)
Germany	600	150
Norway	700	175

[1] Denmark banned the use of cages in 1951, but has since legalised their use.

[2] The bracketed figure refers to larger birds.

The differences in minimum hen area standards between nations listed is striking and cannot be adequately explained by such factors as hen size, climatic variations, etc. Nor can the differentials be attributed to the presentation of different scientific evidence. However, the differences in standards are probably explained by the different and in many cases, subjective interpretation of the same set of scientific evidence.

The Threat to Modern Agriculture from Animal Welfare Organisations

It cannot be seriously suggested that the animal welfare movement will ever stop society eating animal products and wearing fabrics produced from animal fibres. This view is also supported by Singer in his publication "Animal Liberation". However, these organisations may significantly modify existing production techniques, and as a result, change society's eating habits, the prices of animal products and the profitability of livestock farming.

Why then, has the animal welfare movement been so successful in such a short period of time? The following reasons can be advanced:

i) Its public relations are good and it has utilised this in personal and public representations to governments.

ii) Its members are dedicated to a cause they believe in.

iii) Its approach has been emotional, and, in some cases, hysterical. In using this approach, they have made headlines and misled an essentially suburban audience.

iv) It moved a force of animal welfare organisations to also lend support. This has achieved for them some legislative change and also some degree of acceptance by both politicians and the general public. For example, recent amendments to the NSW Prevention of Cruelty to Animals Act.

It has been naively suggested that livestock producers should infiltrate the ranks of the RSPCA and other animal welfare/liberation organisations. Such moves are not practical since firstly, the ploy is obvious and easily exposed and secondly, the organisations would simply not stand for it. In addition, a need exists for primary producers to continue to contribute to animal welfare in a positive sense. This already occurs through a variety of slaughter levies, which assist the funding of industry research, some of which is directed at animal welfare.

It is possible to treat the mandates of animal welfare organisations with contempt and/or amusement. If the primary producers and their organisations take this course, the animal welfare movement will achieve massive legislative changes which will have far reaching consequences for livestock industries in Australia. This is not the stand which the farmer organisations, certainly in NSW, have decided to adopt.

Not all of the mandates and proposals of animal welfare organisations can be completely dismissed as being incompatible with those of the livestock industries. Some must be studied very closely. For example, in the area of mutilation, the pig industry has moved away from castration on the basis of improved productivity. It is widely recognised that entire male animals have faster growth rates and leaner carcases then castrated males. Now while there are obvious practical difficulties in the sheep and cattle industries, castration in southern Australia may well be a practice which is terminated at some point in the future.

In some areas, the producers of livestock and animal welfare organisations could easily be allied. This is especially in relation to the transport of stock and the fact that both seek to reduce animal injury and bruising. Animal welfare organisations may well hasten development of computerised marketing systems which substitute for the conventional fat suction sales of today. If this occurs, it will necessarily be a good thing and perhaps at some stage in the future, livestock producers might well be able to thank such organisations for their endeavours in certain areas.

However, because of the extreme philosophical views held by some sections of the animal welfare movement, many of their mandates are generally incompatible with those of the commercial livestock industries, and thus constitute a definite threat to some areas of livestock production.

The animal welfare movement poses two distinct threats to Australian livestock industries, and these are --

i) Possibility of legislative reform, which may be either partially or completely against the interests of livestock producers.

ii) The continuing erosion of public confidence in modern livestock systems, brought about by sensational and often inaccurate public statements by the animal welfare movement.

The intensive [illegible] will obviously [illegible] the challenges from animal welfare organisations. However, the feedlot industries and the extensive cattle and sheep industries will also face similar challenges at some point in the future.

Conclusions

It is important to note in conclusion that many attempts have been made to define "animal welfare" by researchers, but as yet no universally accepted definition has been forthcoming. Despite this, the layman animal welfarist has attempted to subjectively and emotionally discuss animal welfare questions. In any event, it is doubtful whether research will give us any real capacity to appraise the subjective feelings of animals.

In no other part of the livestock industries has the effect of intensification of production systems had such a dramatic effect on food production as in the poultry and pig industries. Up until the 1960's, the production of eggs, poultry and pig meats had changed little since medieval times. This revolution in production systems and the efficient management of them, has in the process, considerably increased the standard of welfare which animals within those production systems enjoy.

There has been much discussion of so-called "open range" systems of production as alternatives to the intensive housing systems which are currently adopted in both the above industries. Suggestions in this area are basically unpractical and unpublished research conducted in Britain shows that if battery production systems in the poultry industry were in fact banned, approximately 100,000 hectares of prime agricultural country would have to be taken out of other alternative forms of production to maintain egg production at current levels. Sample survey work in Switzerland has highlighted the fact that 70% of the people interviewed favoured legislative changes to ban battery production systems. On the other hand, 70% of the people interviewed were also against paying any higher price for eggs which would be produced from alternative production systems. In Denmark, research has shown that eggs from so-called open range production systems, only account for

some 4% of the total market.

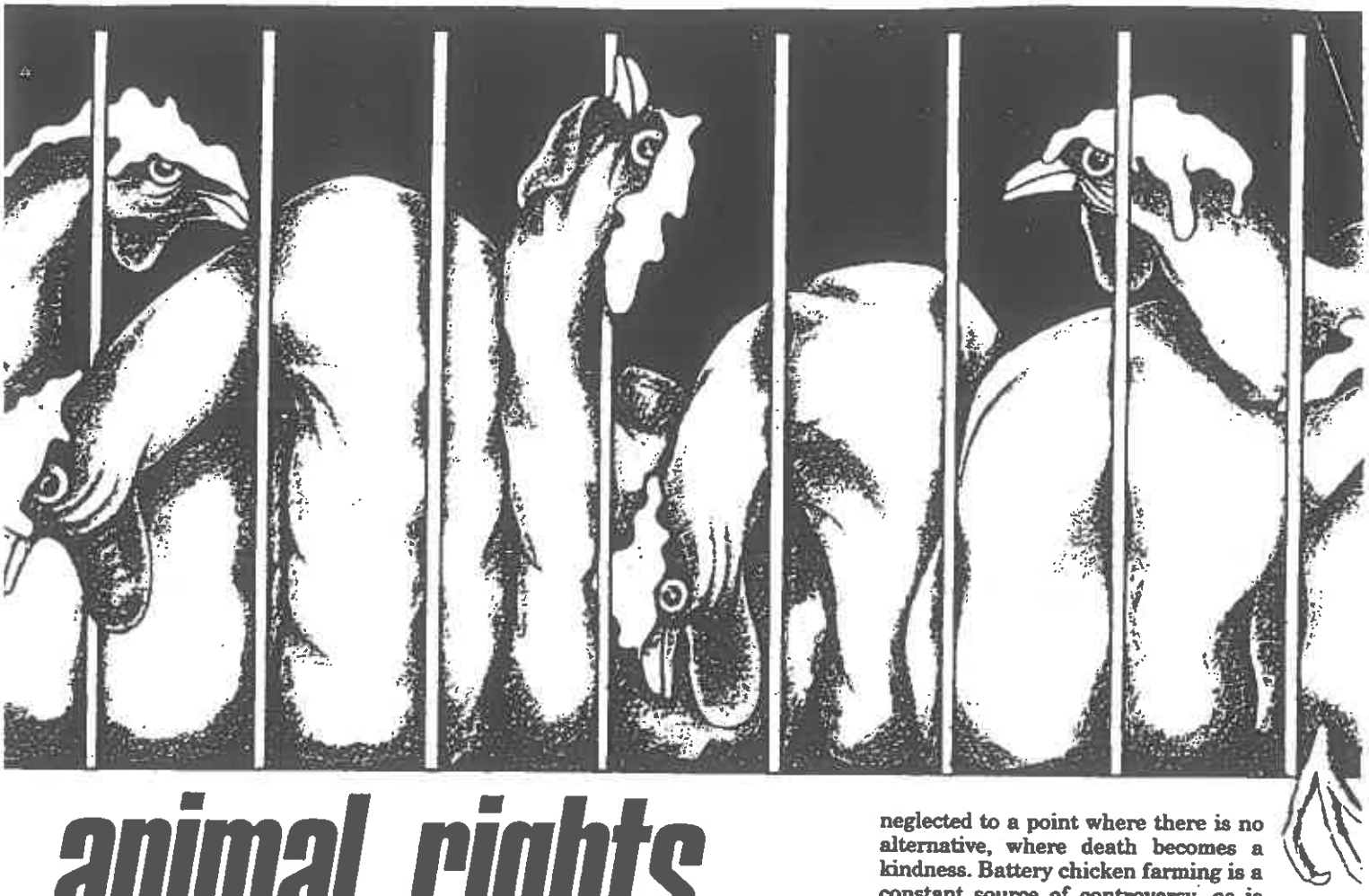
Again, it has been claimed by animal welfarists that Australian farmers have adopted technology in the form of so-called intensive production systems simply to further their own economic gain. Again, such comments show a basic lack of knowledge of agriculture and the fact that technology has been adopted simply because of the pressures of the cost-price squeeze which is confronting agriculture today. High labour costs have obviously meant a substitution of capital for labour in the form of capital intensive technology. Thus, the adoption of technology has occurred because of basic structural changes in society itself, and not because farmers have in fact adopted technology for technology's sake. In addition, claims that the intensification of production systems in both the pig and the poultry industry has led to reduced animal welfare levels have simply no basis in fact. On the contrary, most scientific evidence available shows that such intensification has in fact, improved animal welfare levels. There is no doubt that livestock industries must adopt "codes of conduct", which stipulate minimum standards with respect to husbandry practices, housing and equipment. These "codes of conduct" must be acceptable not only to the industry itself, but also to governments, animal welfarists and the general public.

On a slightly different note, it is apparent that primary producer organisations and State and Federal Departments of Agriculture must attempt to educate suburban populations as to the reasons for existing livestock husbandry practices.

The assessment of new livestock husbandry and production systems must also be based equally on both welfare and economic considerations. In addition, provisions must exist within tertiary courses, to educate students in animal welfare areas.

Livestock producers themselves, through a variety of slaughter and export levies, contribute large amounts of their own monies into research. A need definitely exists to publicise the fact that such funds are being increasingly channelled into projects which aim at assessing animal welfare levels. In fact, perhaps the animal welfare movement, which at this point has been emotionally and subjectively critical of existing animal welfare standards, should be invited to contribute to the funding of animal welfare projects.

In conclusion, society must be made to understand that the use of livestock for food production invariably imposes some constraints on the behavioural patterns of animals, no husbandry system can completely cater for animal welfare in the absolute sense. This is not to suggest that the subject of animal welfare should be ignored in the future, or that it has been ignored in the past.



animal rights

Of course you're concerned— but could you give up roast dinners, fur coats and miracle drugs?

IN FRANCE, car crash tests are conducted with live monkeys strapped into simulated seats. In England, an experiment in the transfer of fertilised eggs resulted in a horse giving birth to a donkey and a donkey giving birth to a horse. In Japan, a biology professor has been experimenting with implants of fertilised human eggs into a monkey's womb. In America, recently, a company (backed by government money) was prosecuted for cruelty to cats; thousands of cats were deprived of various senses: sight, touch, smell, hearing. Most had their spinal cords severed. The reason? To find out what effect this had on their reproductive organs and ascertain whether the behaviour of sexual deviants might be connected with sensory deprivation.

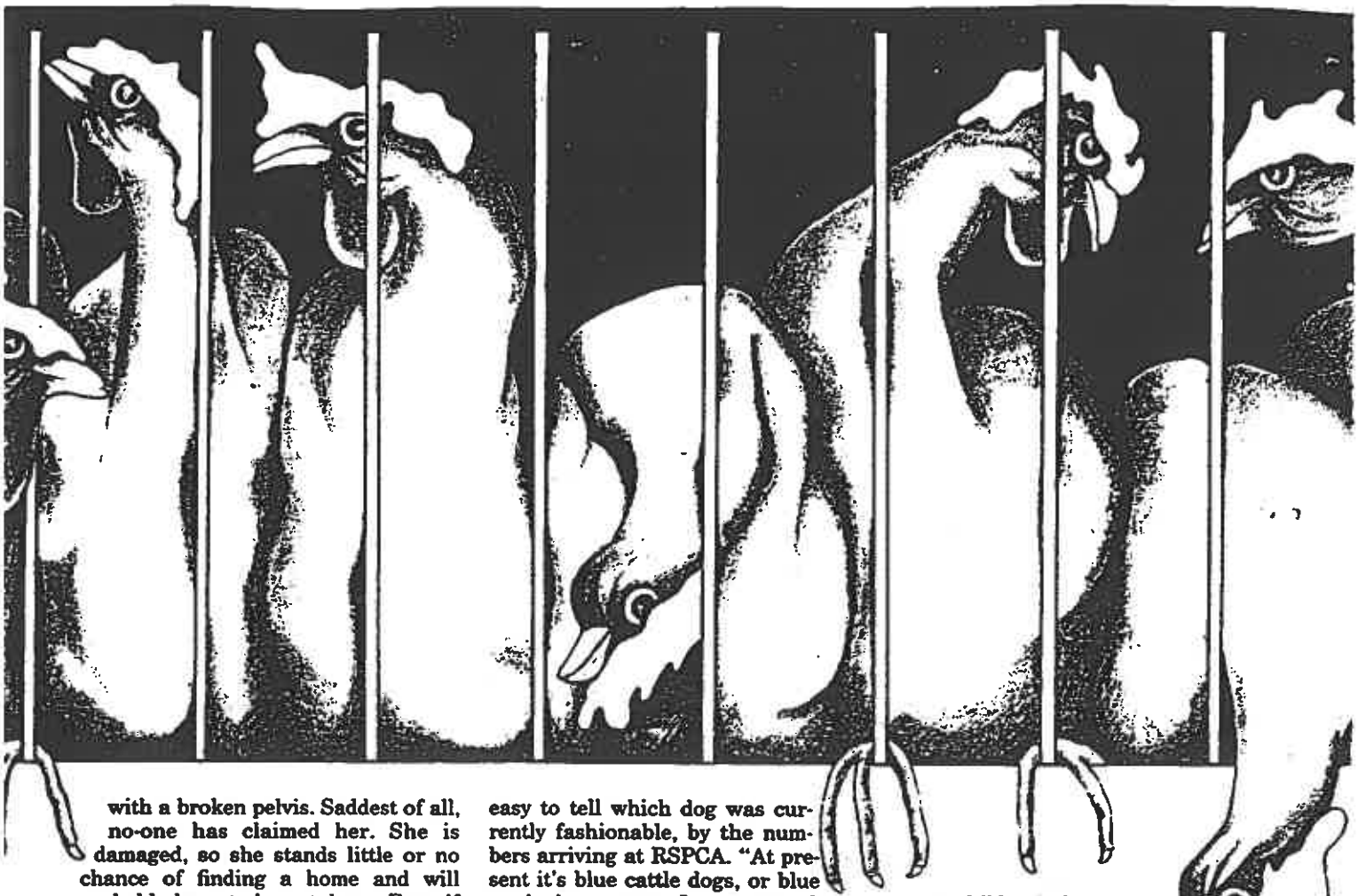
Most of us are aware that animal cruelty exists. Nobody could fail to be sickened at the sight of the new-born, pure white harp seal pups being clubbed to death every spring. In pursuit of what? The thrill of owning a fur coat or a pair of boots or, even worse, ending up on the list of ingredients on a can of pet food?

All of us have read horrific newspaper stories of isolated cases of cruelty, of cats, dogs, horses, birds, rabbits and frogs, maimed, starved or neglected to a point where there is no alternative, where death becomes a kindness. Battery chicken farming is a constant source of controversy, as is pig farming, both of which involve questionable methods of killing or transportation of animals.

In New South Wales alone, the RSPCA has to destroy some 40,000 cats and 11,000 dogs a year. They are put down with an injection of sodium pentabarbitone which works within three to 10 seconds; afterwards, the carcasses are burnt in the society's incinerators. It is quick and painless, but it is a life or death decision. Life is extinguished in as short a time as it takes to blow out a candle flame. Why does it have to happen?

Maree McCaskill, the RSPCA's publicity officer, is outspoken on the subject of animal cruelty. "Sometimes it's difficult to remember that ignorance causes most of the problems," she said. "Recently, one of our inspectors found a dachshund, which had had fire crackers attached to its front paws and face and then lit. It had half a face left, and no paws. What's more, it was still alive when we reached it. A young German shepherd bitch was brought in the other day. She'd been thrown out of the window of a car on to one of the busiest streets in Sydney, Parramatta Road. She was giving birth at the time! She was injured during the fall and she continued to give birth in the middle of the road

Illustration by Jeff Champtaloup



with a broken pelvis. Saddest of all, no-one has claimed her. She is damaged, so she stands little or no chance of finding a home and will probably have to be put down. Even if we do catch the people responsible, the chances are they will only be fined a few hundred dollars."

Although educating people in the treatment of pets is vital, the uppermost consideration for the RSPCA right now is cruelty to horses. Last year in Victoria an extreme case was brought to light. "RSPCA inspectors had to remove 90 horses from a 250ha property near Shepparton in Victoria. Three were in such bad condition they were sent to the knackery, 32 either died or had to be destroyed. And 80 of the worst cases had been removed before the inspector got there. The owner could not be contacted," Maree McCaskill said.

Maree's descriptions of the various types of cruelty make one want to perform the same indignities on the humans who have inflicted such suffering. Often it's not calculated cruelty, it's more self-interest and mindless lack of consideration for another species. For instance, inbreeding of dogs is carried to the extent that a corgi will be born with a broken back, a collie with eyes set so far back it will be blind before it's an adult, bulldogs with jaws so distorted that they can scarcely eat.

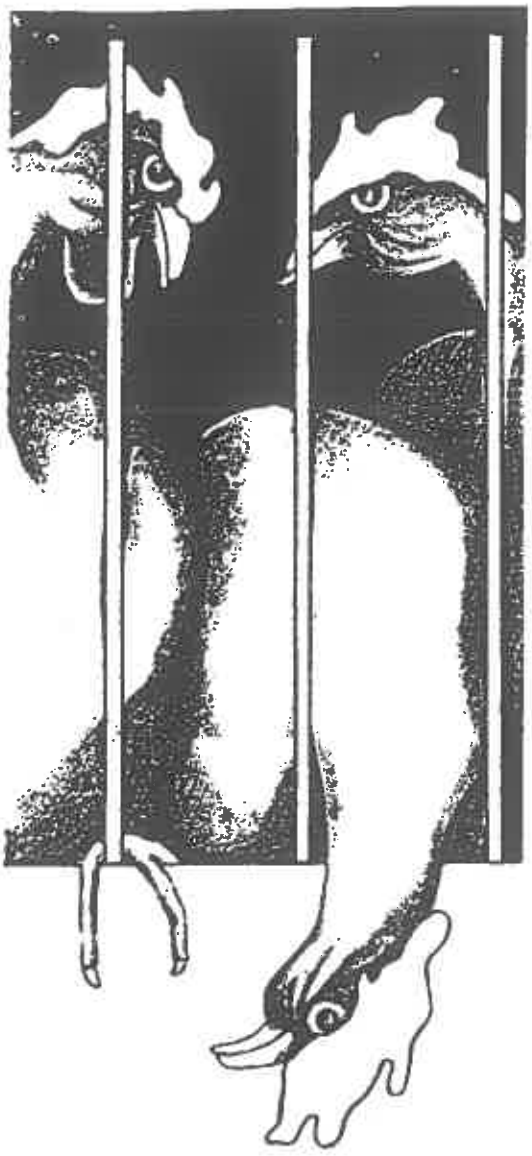
Maree pointed out, too, that it is easy to tell which dog was currently fashionable, by the numbers arriving at RSPCA. "At present it's blue cattle dogs, or blue cattle dog crosses. It seems to change every year; German shepherds, Dobermanns, Afghans, they've all had their day. Trendies don't look after their dogs any better then anyone else. We have a lot of problems with migrant groups, too. It isn't easy to explain to someone who doesn't speak English that a dog must be exercised, fed adequately, watered and housed; and, even if we manage to get through to them, often they can't see why they should do what we tell them.

"Then, there are old people who can't look after their animals properly but insist on keeping them. Often old animals aren't given proper treatment, and are left to wander off and die. Children, too, inflict enormous cruelty on all sorts of animals — cats, dogs, birds, frogs, and they don't seem to care. The latest trend is using newborn puppies and kittens as cricket balls; naturally, parents don't believe us when we tell them what their children are doing. They just don't listen."

Probably the biggest difficulty facing any animal welfare group is getting people to listen and to believe what they are told. Obviously, people who are cruel to animals are in a minority. Most dog breeders are highly respected, ethical, and love their animals. Not all migrants ill-treat pets, most children adore them, and most old people would rather die than see their cat or dog neglected. But cruelty does exist and we should not close our eyes to it.

A group which believes strongly in animal rights are the Animal Liberationists. They are concerned more with farm livestock than domestic animals, but will investigate any complaints of cruelty. The condition of livestock, their environment, treatment, transportation and killing methods are the aspects of farming which concern them. Animal Liberation was formed in 1977 as a registered charity. Committee members include a veterinarian, an agricultural scientist and several primary producers.

"One of our main concerns," says Genny (short for Genevieve), coordinator for the group, "is to try to change the battery system of egg production. Did you know that a hen can spend its entire life in a cage 45cm x 30cm, sometimes with three or four other hens? That's about the size of two quarto sheets of paper — not much for an animal which, ranging freely, likes to wander about, and lay its eggs in a quiet place. Battery hens are de-beaked (a painful process in ▶



"The latest trend is using puppies and kittens as cricket balls; naturally parents don't believe us when we tell them what's happening."

▶ itself) to stop them pecking each other to death from sheer boredom. All of us working here have seen battery hens, and they are a sorry sight. Sometimes the skin on the feet has started growing around the bars of the cages, they are in one position for so long. Feathers are torn and bedraggled, skin is missing in places, and their life span is reduced from four or five years, as a free-range chook, to 18 months as a battery hen. And, most important, we believe there is an enormous demand for free-range eggs which is not being met. We would like to see them side by side with battery eggs in the supermarket."

Jim Macnamara, however, who is spokesman for the National Farmers Federation, takes a rather different view. "The Animal Liberationists have a very distorted view of things," he says firmly. "They are waging unfair war using publicity and the media to get at us, and most of the time they are 80 percent inaccurate. They say, for instance, that we plug the poultry full of antibiotics. Well, that's just not true. We believe we have been working towards animal welfare every bit as much as they have, and much less hysterically. They conveniently ignore the all-important hygiene aspects of intensive farming. Battery hens are completely disease-free. They are fed an excellent diet and the eggs themselves are dirt-free. It's been proved that there is no difference in taste between a free-range egg and a battery egg."

Pigs are another sensitive area for Animal Liberationists, who say the animals are every bit as intelligent as dogs. In Europe they are used for rescue work in avalanches, and snowdrifts because of their highly developed sense of smell. And, contrary to popular opinion, pigs are *not* dirty.

Their cleanliness is probably the only point about pigs that the Farmers Federation and the Animal Libbers agree on. Says Genny: "Pigs are kept in concrete pens with cement or slatted wooden floors that are entirely unsuited to cloven-hoofed animals. Rarely, if ever, do they see the sunlight, which leads to an iron deficiency causing them to chew the bars of their cages and lick their own urine. Sows have five litters in two years. They are prodded into heat artificially and spend a large part of their pregnancy and nursing time in a narrow rack with not enough space to turn around or move sideways. Sometimes they are tied up with 30cm long chains, and their tails are cut off. All this is done to animals which are so sensitive they can die of despair — a condition called porcine stress syndrome. If we were to treat dogs as we treat pigs we would be prosecuted, yet pigs are every bit as intelligent as dogs, if not more so."

Jim Macnamara's answer is again to stress strongly the hygiene aspects, the fact that the meat is free from all disease, in particular, the dreaded tapeworm which can be transmitted by eating undercooked pork. "Again, we don't reject the philosophical arguments," he said. "But I'd like to put out the facts, something the Animal Libbers are rather short on. Firstly, pigs don't spend all their lives in small pens, they are put there to prevent them smothering the piglets, and when they are being mated. It hasn't been proved that pigs chew at the bars because they are iron deficient — they may just enjoy it. They are kept in good health, in clean conditions, with plenty to eat and drink, and surely that makes for a happy pig. Steps to change anything in the farming world must be viable for the farmer; most of the Liberationists' plans are illogical and impractical."

Subjects concerning both groups are the transportation and slaughter of animals. Both worry about the "dry curfew" law, which causes salesyard livestock to go without food and drink for 12 hours to ensure that body weight is accurate. With travelling time, this means that livestock are often up to four days without food or water. Both groups are concerned at the amount of bruising and injury due to overcrowding in crates with sharp edges. The Animal Liberationists believe that most of these problems would be solved if all beasts were slaughtered close to their place of origin, doing away with the long traumatic trip to the slaughterhouse.

A spokesman for the Homebush Abattoir Corporation in NSW explained what happens to the animals at the abattoir. "The beasts — large stock (cattle) and small stock (pigs and sheep) — arrive and are rested for 24 hours in stockyards. On the day of slaughter they are inspected for any diseases, and sick animals are put to one side. The remainder go into a restrainer chute which transports them. The cattle are stunned with a compressed air gun; a door separates them from each other. Sheep and pigs are stunned electrically, one after the other, as they come out of the chute. I don't think you could find a more humane way of killing. The RSPCA have been here many times to check it all

out and are happy with the procedure. It's my belief that pigs and sheep have no idea what is going on. Cattle, maybe, have an idea, but it is as quick and painless as it's possible to be."

After slaughter, the dead animals are given an electric shock, which the CSIRO maintains makes the meat more tender. They say the pH level of a stimulated animal is lower than that of a non-stimulated animal.

One point which worries the Animal Liberationists is the slaughter of animals for kosher meat. These beasts are not pre-stunned, they are locked into a small restraining box, swung upside down and their jugular vein is cut by the kosher slaughterman. The problem is that only the fore-quarter of the beast is eaten. So what happens to the rest? According to the abattoir spokesman, it is sold through ordinary outlets, which means that many of us may be eating non-pre-stunned meat without knowing it. Several countries, including Britain and New Zealand, have banned this method of slaughter, although the RSPCA in Australia has approved it.

While sheep, pigs and cattle are slaughtered under fairly strict regulations, there are no rules governing the slaughter of horses. No-one who saw them will ever forget the plight of the 24 horses taken off a ship about to leave for Japan. Their condition was appalling and, according to the RSPCA, things are even worse once they reach their destination. Here in Australia, the continual over-population of horses means that they are treated in a fairly cavalier, off-hand way, which concerns the RSPCA as much as pre-meditated cruelty.

Sheep, too, are shipped out live to the Middle East in over-crowded, uncomfortable conditions. Their throats are slit by butchers as they are unloaded on the docks at the other end, and there is no guarantee that the butchers aim is always 100 percent. However, constant pressure from all the concerned groups indicates that these situations may change in the near future.

An area that looks a great deal less like changing is animal experimentation, including vivisection. Vivisection is defined as "the act of cutting into or dissecting a living animal body. Experimentation on living animals by means of operations designed to promote knowledge of physiological and pathological processes". But do we have the right to perform experiments of this kind? Elizabeth Ahlston of the Australian Association for Humane Research believes we do *not*. "There is no evidence that animal experiments are leading to less disease for mankind, and to throw away millions of animals each year, for no reason, since humans and animals are so different that the results are often useless, is the ultimate in cruelty. Eraldin (a heart drug) was tested on animals for six years with no ill-effects. On humans the side-effects were so bad that it was withdrawn. In some cases it even caused blindness. And if penicillin had been tested on guinea pigs, it would never have reached humans, since the smallest amount is enough to kill a guinea pig."

Professor K. D. Cairncross, of Macquarie University's School of Biological Sciences, strongly defends the use of animals for experimentation and the way experiments are conducted. "One example I can give you is the breakthrough with a polio vaccine some years ago. The initial testing was done on monkeys and now the vaccine is bred in tissue culture. If we hadn't done that testing, we might still be looking for a polio cure. It seems obvious to me that no intelligent person would cause any animal unnecessary psychological or physical pain. A strong code of medical ethics governs animal experimentation and prevents unnecessary suffering."

It is almost impossible to find out how many experiments on animals are conducted in Australia. Records aren't available to the general public and, in some cases, there is no legislation requiring records to be kept. But there's no doubt that such experimentation has escalated world-wide. In Great Britain, for instance, the total number of *licensed* experiments rose from 270 in 1878 to 5,550,876 in 1970. The percentage of experiments performed without anaesthetic has risen dramatically; it is estimated that now 70 percent of all animal experiments are non-medical and 80 percent take place without anaesthetic. Primates such as chimpanzees, baboons, mouse lemurs, marmosets, squirrel monkeys and other apes are bred by firms throughout the world for experimental purposes. Dogs and cats may come from various pounds. In New South Wales, Penrith, Blacktown and Sutherland Shire council pounds sell dogs due to be put down to university laboratories and the animal house breeding compound at Castle Hill, for the princely sum of $1.

What happens to these animals? They may be subjected to the LD50 acute toxicity test, for evaluation of the toxic effects of new drugs, food additives, cigarettes, cosmetics or insecticides. The test is to find the dose rate that will kill half the animals treated. They may be fed drugs of addiction. They may (shades of Richard Adams' *The Plague Dogs),* be submerged in a tank of water to see how quickly (or slowly) they will drown.

Pro-vivisectionists say that nothing can replace the value of a living animal for experiments. And what price an animal's life when it might save a human? The anti-vivisectionists say that there are enough alternatives to render animal experiments unnecessary in all but a very few cases, and that it's doubtful how much value such experiments have anyway. Besides, even if some experiments are necessary, surely all animals deserve to be treated kindly, not ignored.

The RSPCA in New South Wales was the focus of public attention last year when it was discovered that they had provided 30 dogs for a professor who was looking for a substitute for the poison, 1080, which is used to destroy feral animals. There is also a row at the Yagoona centre which houses the best specimens of dogs to come into the centre. These animals are fed a very high protein diet for two weeks, after which they are stunned, then bled to provide hepatitis and distemper vaccines for other dogs.

The Animal Welfare League, a breakaway group from the RSPCA, condemns these practices totally. Tom Price, the New South Wales secretary, told me that: "No animal given into our care will be put down unless it isn't in a fit state to live. We find homes for all our cats and dogs, and those homes are carefully checked. We condemn all animal experiments, poisoning, etc, and we hope eventually by building sanctuaries, educating the public, and children in particular, to eliminate most of the causes of cruelty. Some you will never stop, like the man we prosecuted the other day who had approximately 60 dogs, all desperately inbred, with no space, no food and no water. Most of them had to be put down because of malnutrition. And yet, somewhere in his confused state, he didn't know he was being cruel, which is why we put such strong emphasis on de-sexing of pets."

In Marie McCaskill's words: "I don't believe that most people are guilty of premeditated cruelty, but they don't care enough either."

Perhaps that's the whole problem — we don't care *enough.*

— Candy Baker

Model Code of Practice for the Welfare of The Pig

This Model Code of Practice for the welfare of animals has been prepared by the Sub-Committee on Animal Welfare (SCAE) of the Animal Health Committee within the Australian Agricultural Council (AAC) system.

Membership of SCAE comprises represesntatives from each of the State Departments with responsibility for agriculture, CSIRO, Commonwealth Department of Health, Australian Bureau of Animal Health and other committees with the AAC.

This code is intended as a model to enable the states to develop codes of practice to meet their individual needs. It was endorsed by Australian Agricutural Council at its 116th meeting (Sydney, February 1983) for consideration by States in consultation with their industries.

The Model Code may be revised to take account of advances in the understanding of animal physiology and behaviour, technological changes in animal husbandry and their relationship to the welfare of animals.

Introduction

This Code of Practice is intended as a guide for all people responsible for the welfare and husbandry of pigs. It recognises that the basic requirement for the welfare of pigs is a husbandry system appropriate to their physiological and behavioural needs. The basic needs of pigs are:

- Readily accessible food and water to maintain health and vigour.
- Freedom of movement to stand, stretch and lie down.
- Light during the daylight hours.
- Visual contact with other pigs.
- Accommodation which provides protection from the weather and which neither harms nor causes distress.
- Rapid identification and treatment of vice, injury and disease.

The Code emphasises that, whatever the form of husbandry, managers and others responsible for the day-to-day needs of pigs have a responsibility to care for animals under their control.

The importance of competent stockmanship in animal welfare cannot be over-emphasised, and those responsible should seek expert opinion when pigs are in ill-health. Managers are encouraged to treat their animals efficiently and with consideration.

Assistance with the establishment of piggeries and advice on the management of and disease control in pigs can be obtained from qualified advisors in private or government employment.

This Code of Practice is based on the knowledge and technology available at the time of publication, and may need to be varied in the light of future knowledge. It does not replace the need for experience and commonsense in the husbandry of animals.

Accommodation

Anyone who intends to erect new housing or redesign old housing should seek advice from government agricultural authorities and others with expert knowledge in this field. Well designed and constructed buildings can provide an ideal environment for pigs, and are often more economic to operate and less expensive to maintain.

1. Space

Accommodation for pigs should be designed and constructed so that it does not cause injury or predispose to disease, and to provide a clean dry place on which to lie.

Pigs kept in groups require sufficient space for each to sleep and feed. They should have a clean dry place on which to lie (see Appendix 2).

Pigs accommodated individually in pens, stalls or tethers should be able to stand normally, lie with limbs extended and to stretch. They should have sufficient space in which to feed and sleep, and a clean dry place on which to lie (see Appendix 2).

The space allowance and facilities provided for suckling sows should aim to avoid overlaying of piglets.

Floors should be constructed and maintained so as to minimise the risk of injury or disease, and to allow pigs to stand normally.

All surfaces and fittings to which pigs have access should be made of materials that can be cleaned and disinfected.

2. Equipment

All equipment to which pigs have access should be designed and maintained so as to avoid either injury or pain.

Mechanical equipment essential to meeting the basic requirements of pigs should be inspected regularly and kept in good working order.

In case of breakdown of mechanical equipment, alternative ways of providing feed and water and of maintaining a satisfactory environment should be available.

An alarm system should be installed to warn the stock-keeper of failures of any automated ventilation equipment.

All electrical installations at mains voltage should be inaccessible to pigs and properly earthed.

3. Environment

Shivering and cold-stress in new-born piglets should be avoided through the provision of bedding and/or supplementary heating.

In intensive housing systems, wide or abrupt temperature fluctuations within any 24 hour period should be avoided. Extremes of air temperature or of humidity, particularly those liable to cause heat stress, should not be deliberately maintained.

In enclosed houses, the level of air exchanges should provide fresh air for respiration, remove excess heat and waste gases, and minimise the effects of dust and excess moisture. Efficient ventilation is particularly important when fermentation pits are associated with slatted floor systems.

Sufficient lighting should be available when required to enable the proper inspection of all pigs. As a guide, 110 lux is sufficient for general purposes.

4. Protection

Pigs should be protected from predators and, where injury from bullying or fighting may occur, from other pigs. Where unfamiliar pigs must be mixed, this should be done in a manner that minimises aggression, such as use of a new pen, provision of feed on the floor, or use of a pen with room for escape.

Action should be taken to prevent bullying or deprivation of food in groups of dry sows and gilts. Stalls in which dry sows and gilts can feed individually are strongly recommended.

When individual quarters or tethers are provided for dry sows and gilts, they should be able to feed and lie down normally. Partitions should prevent aggressive behaviour but enable them to see each other.

Fire-fighting equipment should be available to all pig houses, eg fire hoses should be capable of delivering sufficient water volume and pressure to control a fire in any building or part of any building.

When planning new buildings, consideration should be given to the use of construction materials with a high fire resistance, and all electrical and fuel installations should be planned and fitted so as to minimise the fire risk.

New buildings should incorporate sufficient exits to facilitate the quick evacuation of pigs in emergencies.

Pig housing should be sited so as to be safe from the effects of fires and floods.

5. Waste Control

The frequency of cleaning of pig accommodation will depend on the system of housing used, the type of flooring and stocking density. As a guide, pens with solid floors should be cleaned daily. Faeces and urine should not be permitted to accumulate to the stage where they pose a threat to the health and wellbeing of pigs, or disrupt the normal instinct of pigs to have separate dunging and sleeping areas.

FOOD AND WATER

1. Food

Pigs should be fed at least once each day, and the diet should be nutritionally adequate to maintain health and vitality and take account of the requirements of growth, pregnancy and lactation.

Medicated food should only be used on competent professional advice, as the overuse or mixing of medicaments, or the medicament itself, may cause toxic injury.

There should be enough food on hand, or ready means of obtaining food, in case supply fails or is delayed.

2. Water

Drinkable water or other wholesome liquid should be available in sufficient quantities to meet the physiological needs of the pigs.

Medicated water should only be used on competent professional advice, as the overuse or mixing of medicaments, or the medicament itself, may cause toxic injury.

When a piggery is first established, or a new water source obtained, the water should be tested for salt content and microbiological contamination, and advice obtained on its suitability for pigs. As the composition of water from bores, dams or water holes may change with changes in flow or evaporation, the water may require more frequent monitoring for suitability for pigs. Information on water testing can be obtained from the local office of the Department of Agriculture.

The daily consumption of water by a pig can vary according to environmental temperature and liveweight. The table below shows the range of daily water consumption by various classes of pigs.

Water requirements per pig.

	Average water consumption (Litres/day)
Boar or dry sow	12—15
Sow and litter	25—45
Grower pig: 25kg	3—5
45kg	5—7
65kg	7—9
90kg	9—12

(Conversion factor: 1.0 litre = 0.22 gal)

The piggery should be serviced by an adequate reserve water supply in case of breaks, repairs or failure of pumping equipment.

SPECIAL REQUIREMENTS

1. Inspections

The frequency and level of inspection should be related to the likelihood of risk to the welfare of pigs, but should be at least once each day. Inspections are best made at feeding times. Under certain circumstances more frequent inspections may be required, such as during hot weather, during outbreaks of disease or vice, when farrowing is expected, when groups of pigs have been mixed, or where sows are tethered. Checks should also be made of the effectiveness of any automated feeding or watering systems where these have been installed.

2. Health

Those responsible for the care of pigs should be aware of the signs of ill-health. These include separation from other pigs, refusal to eat, changes in faeces or urine, reduced production or fertility, vomiting, skin discolouration, shivering, sneezing, coughing, panting, lameness, and swellings on the body. If the person in charge is not able to identify the causes and correct them, he should seek advice from those having training and experience in such matters. Such persons may be specialist pig verterinarians or other qualified advisors in private practice or government employment.

Pig producers should also operate an effective programme to prevent infectious disease, and internal and external parasitism. Vaccinations and other treatments applied to pigs should be undertaken by people skilled in the procedures and in accordance with the manufacturer's directions.

Sick and injured pigs should be treated as soon as possible. They should be isolated if necessary.

Dead pigs should be removed promptly and, if not required for postmortem examination, should be disposed of in a hygienic manner such as incineration or deep burial.

Records of sick animals, deaths, treatment given and response to treatment should be maintained to assist disease investigations.

Pigs with either incurable sickness or painful deformity should be humanely ▶

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slaughtered as soon as possible. The recommended method of destruction is described in Appendix 3.

3. Farrowing

Sows should be placed in farrowing quarters before the litter is due, to allow them to become accustomed to their surroundings.

4. Boars

The floor of the serving area should be well maintained and should not be slippery.

5. Additional Requirements for Pig Keeping Under Extensive Conditions

The same welfare standards as are applicable to housed pigs should be observed where pigs are kept outdoors.

Huts for farrowing and rearing should be warm and draught-free.

Adequate shelter in winter and shade in summer should be available to all pigs.

Pigs should not be raised on land which is grossly contaminated with poisonous plants or organisms that may either cause or transmit disease to such an extent that the health of pigs is affected. Consideration should be given to methods of reducing the build-up of such pathogens by the use of herd health programmes, such as routine vaccinations, parasite control and regular pasture rotation and spelling.

Fire breaks should be established around pasture or open range systems where the risk of fires is high.

Where large groups are kept outdoors, adequate feeding space and watering points are essential. Operators should ensure that younger or more timid pigs which may be subject to bullying have access to feed, or are confined with more evenly matched groups of pigs.

If grazing pigs are tethered to a long length of rope or chain, the design and length of the tether should not allow them to become entangled with housing, trees or with each other. The tether should also permit access to water at all times. The harness should be checked regularly to ensure that there is no discomfort or injury to the animal. (See Appendix 2).

APPENDIX 1
MINOR SURGICAL PROCEDURES

1. General

Managers or employees should not carry out minor surgical operations unless they are competent in such procedures. If necessary, advice should be sought on how minor surgical procedures should be performed. They should understand that minor surgery causes little distress if carried out efficiently and with minimal restraint. Strict attention should be paid to:

- Suitability of the area in which the operation is to be performed.
- The catching facilities.
- The type and amount of restraint.
- The selection and maintenance of instruments.
- Hygiene.
- After-care of the animals.

Restraint used on pigs should be the minimum necessary to complete the procedures. The use of goading devices for moving and handling pigs should be minimised to avoid distress.

2. Castration

Castration should be avoided wherever possible.

If, however, castration is considered necessary, it should be performed by a competent operator as early as management practices will allow. Castration using a knife is recommended, provided the animal is adequately restrained. Good post-operative drainage is essential.

Castration of boars older than eight weeks should be performed by a veterinarian using either local or general anaesthetic.

3. Tail-Docking

Where tail-biting is a problem, all aspects of the environment, feeding and management should be investigated to identify the contributing factors so that remedial action can be taken.

Tail-docking should be carried out before pigs are seven days of age where it is being performed as a routine preventive measure.

Tail-docking of pigs over seven days of age should be performed only in an emergency.

4. Clipping of 'Needle' Teeth

When performed, this procedure should be done within two days of birth to protect littermates and to prevent damage to the sow's udder.

5. Nose Ringing

This may need to be practised when pigs are kept on pasture. Rings should be placed through the cartilage of the top of the snout or the tissues separating the nostrils.

6. Identification

Where it is necessary to mark pigs for permanent identification, the ear may be tattooed, tagged, notched or punched, or the body may be tattooed.

7. Backfat Measurement

The preferred method uses ultrasonic equipment. The use of mechanical probes should be discouraged.

8. Tusk Trimming

Tusk trimming of boars is advisable where injury to man or animals is likely to occur.

Acceptable methods of tusk trimming are bolt cutters, hack saw or embryotomy wire. The boar should be appropriately restrained, preferably aided by the administration of a sedative. No anaesthetic is required as the tusk lacks nerves for sensory innervation. Tusks should be severed cleanly and skilfully above the level of the gums without causing damage to other tissues.

Table 1: Maximum recommended stocking densities for housed pigs.

System	Minimum space allowance (m^2 per pig)	Comments
Growing pigs up to 10kg in groups	0.11	
11—20kg	0.18	Approximately 20 to 30 percent of space
21—40kg	0.32	allowance provides for a dunging area
41—60kg	0.44	
61—80kg	0.56	
81—100kg	0.65	
Adult pigs in groups	1.4	
Adult pigs in individual stalls	0.6 x 1.8m	
Boars in pens used for mating	6.25	Minimum length of shortest side 2m
Lactating sows and litters:		
— stalls	3.2	With piglets up to 4 weeks of age
— individual pens	5.6	
— multisuckling groups	5.6	For each sow and litter

(Conversion factors: 1.0m^2 = 10.8ft^2; 1.0kg = 2.2lb; 1.0m = 39.4in)

APPENDIX 2
ACCOMMODATION

1. Stocking Density

It is not possible to relate stocking density to welfare in a simple manner. Adequate welfare involves consideration of group size, pen size, age, breed, temperature, ventilation, lighting and other husbandry factors. The observance of any particular stocking density on its own cannot ensure the welfare of pigs. The suggested minimum space allowances in housed pigs based on contemporary tech- ▶

niques are shown in Table 1.

2. Temperature

Pigs, except the very young, are able to tolerate a wide range of temperatures without detriment to their wellbeing, provided temperature changes do not occur abruptly.

The ranges of temperature that afford optimum comfort for different classes of pigs are:

Piglets — newborn	27—35C	
Piglets — 3 weeks of age	24—30C	(reducing to 21C at 5 weeks of age)
Farrowing house	20—30C	
Weaners	20—30C	
Growers	15—30C	
Finishers	15—30C	
Sows and boars	15—30C	

During very hot weather (38C or more), adult pigs are very susceptible to heat stress, and steps should be taken to alleviate distress and avoid deaths. Pigs may die if transported in very hot weather.

3. Ventilation

It is necessary to strike a balance between the need to provide fresh air and prevent the build-up of noxious gases, and the need to protect pigs from draughts.

In general, if the level of irritant or toxic gases within a building is uncomfortable to man, it is also uncomfortable to pigs and may predispose them to respiratory diseases.

The presence of ammonia is usually a reliable indicator of the build-up of noxious gases; it should not be allowed to exceed 20 parts per million (ppm) of air in an enclosed pig house without immediate corrective action being taken. (A level of 10—15 ppm ammonia in the air can be detected by smell. An ammonia level of from 25 to 35 ppm will cause eye and nasal irritation in man.)

It is important to maintain an adequate airflow during hot weather to ensure housed pigs do not become overheated.

4. Tethering

Tethering is an undesirable means of restraint, and should not be used unless there is careful and continuous attention and a high level of expertise in the management of animals and equipment. Tethering can lead to problems in the welfare of sows, and producers are encouraged to consider alternative systems of management in the establishment of piggeries.

Tethers, if used, should be capable of being adjusted for size, and fitted and maintained so that pigs are not subjected to injury and pain. The animals and tethers should be regularly inspected and the tethers should have a quick release mechanism.

APPENDIX 3
HUMANE DESTRUCTION OF PIGS

Previous sections of this code have drawn attention to those circumstances when, for humane reasons, pigs may need to be humanely destroyed, eg injury or disease.

Whilst this task is aesthetically unpleasant to most people, the method of slaughter should be effective and cause sudden and painless death for the animal. It is equally important that the animal be handled quietly beforehand to ensure it is not unnecessarily distressed or alarmed.

The methods recommended hereunder are those which are considered the most suitable for a farm situation.

1. Use of the firearm

This is the preferred method of humanely destroying older pigs on the farm or following emergencies. Use of firearms on public property, eg roads, or in built-up areas may be illegal, and under those circumstances assistance should be sought from veterinary practitioners, the RSPCA or the Police.

The effectiveness of shooting is dependent upon the destruction of major centres at the back of the brain near the spinal cord. A common mistake is to direct the bullet too low, damaging frontal areas. Partial recovery may then occur.

(a) Safety

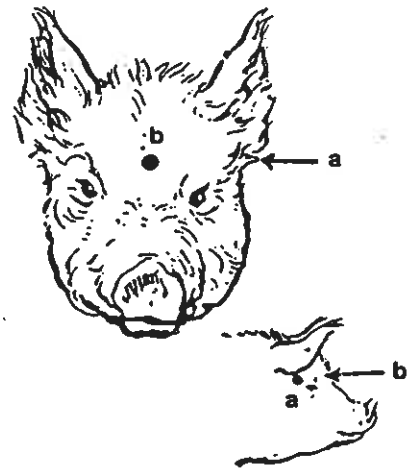
The following aspects of firearms safety should be borne in mind:

- A .22 calibre rifle or .32 calibre humane killer pistol are adequate for humane destruction of most pigs. Where old, large boars are to be destroyed, the .32 calibre pistol is preferred.
- Any use of firearms is hazardous.
- Persons other than the marksman and a handler for the animal should be cleared from the area or should stand well behind the marksman.
- Never fire while the animal is moving its head; wait patiently for a quiet interval before firing.
- To provide maximum impact and the least possibility of misdirection, the range should be as short as circumstances permit.
- Whilst the humane killer pistol and captive-bolt pistol are designed to be pressed firmly on the head prior to being discharged, it is not safe to do this with a standard rifle or pistol.

(b) Methods

Temporal method: The pig is shot from the side of the head so that the bullet enters the skull at a point midway between the eyes and the base of the ear on the same side. The bullet should be directed horizontally into the skull. This method is preferred for adult pigs due to the heavier bone structure of the front of the skull.

Frontal method: The firearm should be aimed at a point midway across the forehead and (for adult pigs) about 2cm above the level of the eyes, aiming horizontally into the skull.



Humane destruction of pigs:

'a' indicates recommended position for temporal method (suitable for firearms only).

'b' indicates recommended position for frontal method (suitable for firearm or captive-bolt pistol).

2. Use of the captive-bolt pistol

An alternative to the firearm is a captive-bolt pistol which is safer since a blank cartridge is used. The operator does not have to be a marksman, as the instrument's muzzle is firmly pressed against the skull before firing. It must, however, be assumed that the animal has only been stunned and a follow-up method of ensuring death, such as bleeding-out, is required.

Blank cartridges for the captive-bolt pistol are colour-coded according to the amount of charge they contain. For best results, the manufacturer's directions should be followed on the most appropriate blank cartridge for pigs. Regular maintenance of the captive-bolt pistol is essential for efficient stunning.

(a) Method

When using the frontal method, the captive-bolt pistol can be used in the same position as that recommended for the firearm. To ensure death, pigs should be bled out as soon as possible after collapse.

3. Stunning by clubbing

A hammer or other blunt, but heavy, object may be used to make a blow to the skull to render unconscious small, easily controlled piglets. The blow should be aimed at the centre of the forehead in the position indicated for shooting in the diagram above. The unconscious piglet should be immediately bled out to ensure death.

Summary of Main Recommendations

POULTRY FARM SITE

Area—minimum of 10 ha and large enough to allow for future planned expansion of production capacity.

Shape—avoid long narrow blocks or blocks where potential building sites are too close to planned or existing poultry operations on adjoining land.

Topography—an elevated site is preferred. Avoid low lying, poorly drained, landlocked or steeply sloping sites.

Water Supply—must have a guaranteed supply of good quality water in excess of projected peak demand. Check on suitability of water for stock through Department of Agriculture or private water analysis service.

Power—consider availability and cost of bringing power on to site. Decide whether planned operations will require 3-phase power.

Access—must have all weather access road capable of handling heavy vehicles of up to 35 tonnes.

Allow for through flow of traffic or provide adequate turning circle.

Isolation from other Poultry Farms—as a general rule, the greater the separation distance between flocks on adjacent farms the better. In practice aim for a minimum separation distance of about 250 m.

Proximity to Feed Mill and Markets—broiler companies prefer broiler farms to be located within 40 km of feed plant and processing works. Egg producers should consider freight cost on feed and proximity to any egg pick-up service when choosing a farm site.

Land Use Conditions—check with the Local Authority, most have consent-use conditions and building approval is required.

PLANNING AND LAYOUT OF BUILDINGS

Minimum Separation Distances from Poultry Sheds to the following:

- ☐ Settlements of more than 10 houses — 300 m
- ☐ Well trafficked public roads — 100 m
- ☐ Other boundaries, dry gullies and channels. — 30 m
- ☐ Watercourses, wells and bores — 100 m
- ☐ Neighbouring houses — 150 m
- ☐ Dwellings on the same farm (applies only when birds are housed on deep litter). — 100 m

Minimum Separation between Poultry Sheds on the same farm:

- ☐ Parallel broiler sheds, pullet sheds, breeding sheds. — 15 m
- ☐ Parallel high rise layer sheds — 30 m
- ☐ Laying sheds and rearing sheds — 100 m
- ☐ Laying sheds and egg holding room — 40 m

MANAGEMENT PROCEDURES

Prevention of Heat Stress

Precautions which can be taken include:

- ☐ Installing roof sprinklers or painting shed roofs white or insulating roofs.
- ☐ Keeping ventilation openings free of obstructions.
- ☐ Installation of fogging systems and fans.
- ☐ Shading ventilation openings.
- ☐ Maintain mown grass cover on shed surrounds.
- ☐ Reducing stocking density in summer.
- ☐ Ensuring that an emergency water supply is available.

MANURE MANAGEMENT

- ☐ Prevent entry of drainage or seepage water and drinker water spillage into manure collection area under cages.
- ☐ Adjust fogging system to minimize amount of moisture reaching manure or litter.
- ☐ Remove wet patches of manure or litter and spread thinly (maximum 10 mm) on the manure disposal area.
- ☐ With layers in standard cage sheds manure removal will normally be done 2–3 times per year preferably in dry weather during autumn and spring. Leave 15 cm of the dry base of manure cones at each cleanout.
- ☐ Chicken litter is re-used for several batches of birds before being completely cleaned out and replaced with fresh sawdust/shavings.
- ☐ Limit the use of insecticides in fly control programmes to application of baits and contact types in areas where flies rest.
- ☐ Avoid spraying manure cones with insecticides as this also kills off useful insect predators.

DISEASE PREVENTION AND CONTROL

- ☐ Implement an integrated disease prevention and control programme aimed at reducing the risk of disease entry to the farm, preventing spread of disease on the farm and achieving effective control when disease appears.
- ☐ As far as possible keep likely disease carriers such as live birds, visitors, vehicles, and equipment out of the production area of the farm.

DISPOSAL OF WASTES

Carcasses

- ☐ Collect daily and hold in covered storage bins for up to 24 hours before disposal.
- ☐ Where large numbers of birds have to be destroyed, e.g., to comply with a seasonal quota cut, prior arrangements should be made for rendering or burial of the carcasses.

Disposal Methods

Burial—use a self-draining trench 0.75 m deep and up to 2 m wide. Cover each day's carcasses with 0.3 m earth. Enclose the disposal area with a dog-proof fence.

Incineration—must have properly constructed incinerator to achieve high enough temperature for complete combustion of carcasses. Spare capacity required to deal with occasional higher than normal death rate.

Disposal Pit—use only in areas where the pit will remain dry and where there is no risk of contaminating underground water supplies (100 m minimum separation).

Poultry Manure and Poultry Litter

- ☐ Recommended minimum separation distances applying to manure disposal areas are identical to those listed for poultry buildings except that these may be reduced when manure or litter is immediately incorporated in the soil.
- ☐ Other recommendations applying to manure and litter disposal include the following:
  - * The material should be covered when being transported on public roads.
  - * Manure and litter should not be spread more than 10 mm thick on pastures. It may be spread more than 10 mm thick on cultivated areas where it will be incorporated into the soil promptly.
  - * Spreading should be discontinued if wind is carrying dust onto neighbouring properties.
  - * Manure with a moisture content of over 40 per cent should not be stock-piled in the open for more than forty-eight hours without being covered.
  - * Wet litter and manure should be disposed of or treated promptly to reduce odours.
  - * Litter may be stock-piled in the open for composting and is a desirable practice in the open.
  - * Spreading should be avoided in wet overcast conditions when quick drying is prevented.

The Poultry Industry In New South Wales

The poultry industry in New South Wales consists of two sections, which produce either eggs or poultry meats.

The egg industry has been established in New South Wales for the past eighty years. The broiler industry has developed since the late 1950's and its growth has been spectacular. It is expanding at a rate of about 8 per cent a year.

Poultry producers rely on hatcheries, feed mills and processing plants, which for economic reasons are located close to the major poultry producing areas.

Poultry farming is concentrated around areas of large population so that perishable eggs and poultry meat are quickly and economically supplied to the nearby consumer market.

Processing plants are labour intensive, employing many hundreds of people over two and three shifts a day. Processing plants and other labour intensive support industries are, therefore, located near populated areas.

PRACTICAL ASSESSMENT

FOOD CONVERSION EFFICIENCY IN PIGS

Ability to correlate records, express these records in a form that can be analysed and drawing conclusions.

The following table represents the data recorded for a group of piglets that were weaned at 4 weeks of age and marketed as porkers at 16 weeks of age.

Week	Weight at Start of Week (KG)	Daily Weight Gain	Daily Food Consumption Per Pig
4	10	-	-
5	12	0.29	1.1
6	17	0.71	1.1
7	24	1.0	1.65
8	29	0.71	1.8
9	34	0.71	2.27
10	39	0.71	2.27
11	43	0.57	2.0
12	47	0.57	1.85
13	51	0.57	2.5
14	54	0.42	2.27
15	57	0.42	2.54
16	60	0.42	2.85

$$\text{FOOD CONVERSION} = \frac{\text{MASS OF FOOD CONSUMED}}{\text{LIVEWEIGHT GAIN}}$$

Show All Working

1. Calculate the food conversion ratios for

   a) Week 5 _____

   b) Week 7 _____

   c) Week 16 _____

   d) For the whole experimental period _____

2. On the graph paper provided construct the following graphs.

a) Time v's liveweight
b) Time v's Daily Weight gain and Daily Food Consumption
c) Answer the following questions

(i) In which week(s) did the pigs gain the most weight _____

(ii) In which week(s) did the pigs gain the least weight _____

(iii) In which week(s) did the pigs gain the most weight for the least food consumption

_____

(iv) Describe the trends that are demonstrated by Graph B.

_____

_____

_____

_____

_____

3. Assuming 5 porkers were involved in the experiment and feed costs $17.00 for a 50kg bag of grower pellets. What was the total cost of feeding these pigs for this experiment. (Show all working)

_____

_____

_____

_____

_____

4. <u>Your Conclusions</u>

(i) Account for the poor Food Conversion Ratios in weeks 5 and 16

_____

_____

_____

(ii) Account for the very good Food Conversion Ratio in week 7.

_____

_____

_____

(iii) Pretend you are a pig farmer and you have just carried out this experiment on pigs in your piggery. What is the significance of these results to you in terms of managing your enterprise.

PRACTICAL ASSESSMENT

SOILS TEXTURE ANALYSIS

Ability to manipulate keys, follow instructions, make observations, use observations to draw conclusions.

Directions

1. *During this experiment you are to work as an individual.*
2. *Do not discuss your results.*
3. *Complete all sections of the write up in the spaces provided.*

Aim

To determine the soil texture of two unknown soils using the ribbon test and a simple ey.

Method

1. *Place 6 teaspoons of soil Sample A in a petri dish and moisten slightly until you have a putty like mass.*

2. *Remove the putty like mass from the petri dish and then attempt to roll it into a ribbon (cylinder shape).*

3. *Note down your observations in the space provided, then using the Key make a determination of the soil type.*

4. *Repeat the procedure for Sample B.*

2. *Using the information provided on the back of these sheets explain how knowledge of your soil types could affect the managerial strategies that you would use on them.*

SOME SIMPLE SOILS EXPERIMENTS

1. SOIL TEXTURE — A SIMPLE KEY

Work several teaspons of crushed soil into the consistency of workable putty with water then apply the following criteria:

1. Will the soil roll into cohesive balls? NO ---------- SAND
   YES ---------- Go to 2

2. Can the ball be rolled to a cylinder?
   NO - crumbles readily and feels gritty ---------- LOAMY SAND
   YES - Go to 3

3. Does the cylinder break on gentle bending
   YES - and feels gritty ---------- SANDY LOAM
   NO - Go to 4

4. Can the cylinder be worked to form ribbons?
   YES - to 5
   NO - to 6

5. a) Long ribbons will form, sticky feel ---------- CLAY
   OR
   b) Medium ribbons, sticky feel, will polish ---------- CLAY LOAM
   OR
   c) Medium ribbons, silky feel, will polish ---------- SILTY CLAY LOAM

6. a) No grittiness, silkness or stickness ---------- LOAM
   OR
   b) Silky feel, cannot be polished by working between finger and thumb, not gritty ---------- SILTY LOAM
   OR
   c) Like (b) but with gritty feel ---------- SANDY CLAY LOAM
   OR
   d) Like (b) but very silky ---------- SILT

Working in groups of 3 design an assessment task that could be used to assess in the areas of , practical assessment or assignment .

Type of Practical Task Viva or written

Duration for Task Written (2 periods in Class) Viva 10 min/Student

Equipment or Special Reqirements Photograph of dead rabbits and shotgun. Article on myxomatosis

Areas of Student Achievement Being Assessed
Historical importance - aural and oral skills

Question 1. Describe the picture. (open ended)

Question 2. Why were rabbits introduced into Australia? (recall)

Question 3. What damage have the rabbits caused? (observation)

Question 4. What are the maps showing? (interpretation - spread over time)

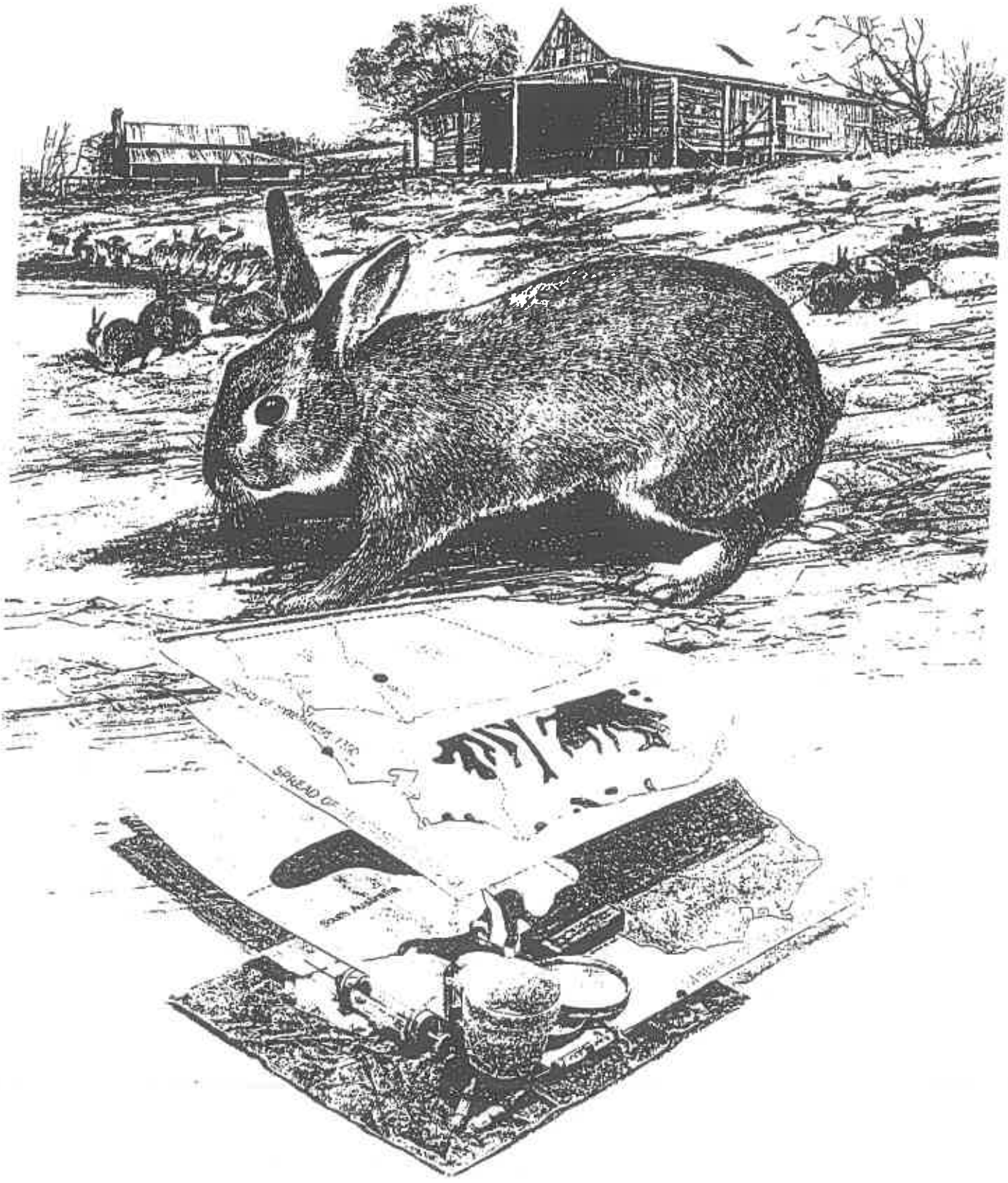
Question 5. Myxomatosis has not been totally successful in controlling rabbits? Can you explain why? Could you devise a better way to control rabbits.

1. MYXOMATOSIS

Farming in many areas of Australia looked bleak until in the 1950s Dr Ratcliffe of the C.S.I.R.O. (Commonwealth Scientific and Industrial Research Organisation) developed the use of the disease, passing it from one animal to another. It spread rapidly, reducing rabbit populations in south-east areas by up to 90%. In recent years, immunity to the disease has begun to build up, so new myxomatosis strains were developed.

2. 1080 POISONING

A poison called 1080 was also introduced to help farmers and wildlife officers control rabbits. Many methods have been used to rid the country of this pest, but so far none has been totally successful.



Working in groups of 3 design an assessment task that could be used to assess in the areas of , practical assessment or assignment .

Type of Practical Task Station Test

Duration for Task 40 min

Equipment or Special Reqirements As per station as selected

Areas of Student Achievement Being Assessed

Reading Measuring

Writing Manipulation

Calculation

Reasoning

Structure

1. Station test with time limits

2. Recommend time limit 10 mins per station with 10 min for initial instruction.

Suggested Stations.

1. Fertilizers - range of fertilizers with analysis from pack
   - give example of plant deficiency e.g. photo of plant showing nitrogen deficiency then ask which fertilizer would you use to correct the deficiency - give a reason, for higher level students what other crops you would use it on.

2. Feeds - give a range of feeds
   e.g. poultry - starter
   grower
   layer
   finisher
   (e.g. identify and select feed for different age groups or type of stock)

3. Chemicals/Drenches/Equipment
   - usage
   - calibration/dosage
   - following directions
   - safety precautions
   - which chemical you would use for a particular pest.

4. Pests and Diseases (This can be linked to 3)
   - identification

5. Seed Identification
   plus - sowing requirement depth/spacing
   - monocot or dicot seed
   - what type of seed bed required

6. Plant Identification

   - choose plants they have studied
   - use a key for identification
     e.g. legumes/grasses

7. Identification of Specimens

Working in groups of 3 design an assessment task that could be used to assess in the areas of , practical assessment or assignment .

Type of Practical Task Practical Test

Duration for Task Double Period

Equipment or Special Reqirements Samples of Plant diseases/pests. Suitable chemicals to control each.

* Could be done on farm, in class, using stations. Depends on teacher and material available.

Areas of Student Achievement Being Assessed

Covers 3rd course descriptor (maybe #5, #7)

PLANT DISEASES/PESTS

1. a) Identify and name a number of plant diseases/pests (from specimens orchard trees provided).

   b) Describe one of the disease causing organisms.

2. Name 2 more pests/diseases that may affect these plants.

3. Name 2 other factors (not pests/diseases) which affect these plants.

4. Which chemicals would be used to control each of the pests/diseases in Question 1 (chemicals provided or photocopies of labels).

5. What precautions should be taken before spraying?

6. Discuss the applicability of non-chemical control methods. Name any that could be used.

HEALTH, SAFETY & WELFARE BULLETIN

SAFETY IS EVERYONE'S RESPONSIBILITY

91/142

JULY 1991 - NO 11

PROTECTIVE CLOTHING AND EQUIPMENT FOR GENERAL ASSISTANTS/FARM ASSISTANTS TEACHERS AIDES (SPECIAL)

Following negotiations with suppliers the Department has been able to identify and make available items of protective clothing and equipment which may be consideredwhen placing orders for new or replacement items of protective clothing and equipment for General Assistants, Farm Assistants and Teachers' Aides (Special).

Overalls for General Assistants/Farm Assistants

Combination overalls are now available in a lightweight material (polyester/ cotton). The Department will issue the lightweight combination overall unless otherwis specified on the order.

Please note the lightweight material is available for COMBINATION OVERALLS only.

Safety Boots for General Assistants/Farm Assistants (who operate motor mowers or tractors)

A lighter weight safety boot is now available in addition to the standard weight safety boot. Please specify on the order.

Wellington Boots for General Assistants/Farm Assistants

Wellington boots can now be ordered in calf length or knee length style.

NSW DEPARTMENT OF SCHOOL EDUCATION
Occupational Health & Welfare Unit (02) 561 1000

Long Sleeve Smock (Teachers Aides (Special)

The protective clothing entitlement for Teachers Aides (Special) has been amended to read two dust coats OR one dust coat and one long sleeve smock OR two long sleeve smocks.

Please note the above entitlements should be ordered through the Supply Branch, Department of School Education, Level 6, 2-10 Wentworth Street, Parramatta 2150, phone 561-1657.

ITEMS IN ADDITION TO ENTITLEMENTS

The Department has identified the availability of the following items which may be considered when schools are purchasing protective equipment for ancillary staff from school funds. Specifically, these items should be used by ancillary staff who work in areas where the risk of infection may be high.

Disposable Gloves

Non sterile, latex gloves are available in small, medium and large sizes. Government Supply Contract 316. Latex gloves are generally more supple and durable than the vinyl type often used in schools.

Disposable Masks

Disposal masks are available on Government Contract No 250 and are generally available through hardware stores at minimal cost.

If you have any enquiries regarding entitlements to protective clothing and equipment for ancillary staff please contact Corporate Services (Schools' Supplies Unit) on 561 1000.

G W Baldwin
Director, Personnel Policies

12/7/1991

ATTENTION: COMPUTER EDUCATION/MATHEMATICS CO-ORDINATOR

COMPUTER ECOLOGY AND CHAOS

An Introduction to Mathematical Computing

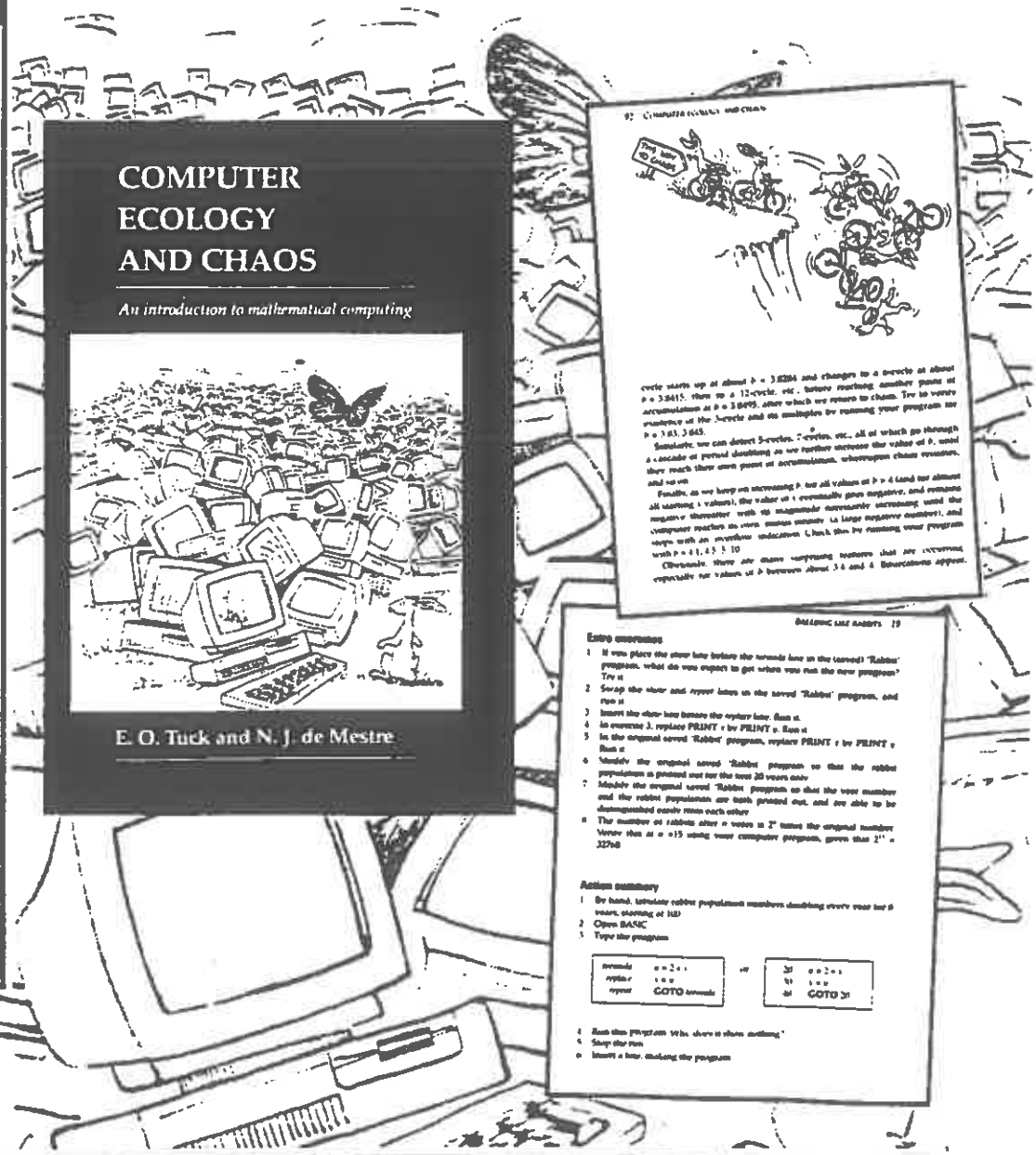
E.O. Tuck and N.J. de Mestre

NEW

Provides the absolute beginner with an introduction to computer programming in an applied mathematical context. It is suitable for use in middle/senior years of secondary school and no previous knowledge of computers or programming is assumed. Only the simplest elements of BASIC — those shared with other languages — are taught, enabling the construction of short programs which illustrate growth and decay processes in the real world.

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- Exercises, chapter summaries, and worksheets are provided as teaching aids
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- The work is of escalating difficulty, ranging from the elementary to current research on chaos.



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BOOK ONE

Neil Hall

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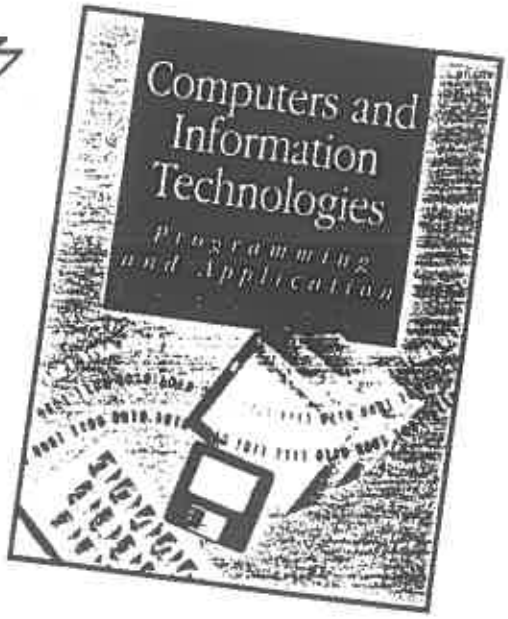
- ✔ hardware
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- ✔ how different kinds of systems work

Each chapter is organised into individual or group, and computer or non-computer activities, with the same structure of headings to assist teaching and learning. Two cartoon characters provide a guide to learning throughout, with *Qwerty* asking the questions and *Dvorak* answering.

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AGRICULTURE

NEW TITLES

MULTIPURPOSE AUSTRALIAN TREES AND SHRUBS

This book was conceived to exploit more fully the potential of Australian trees and shrubs for domestic fuel and agroforestry in developing countries. The main point of the book of descriptions of the botanical, ecological silviculture and utilization of Australian trees and shrubs.

Pub. 1988 $30.00

COPING WITH DROUGHT COLE

This is a permanent record of experiences in Western Victoria in two major droughts. It is written to assist farmers, scientists and policy makers to reach earlier and better decisions on strategies and management in future droughts.
Pub 1988 110pp $18.00

CSIRO RESEARCH FOR AUSTRALIA AGRICULTURE

Topics covered include field cropping, horticulture, pastures, sheep, cattle, pigs and poultry.

Pub 1987 $9.95

CSIRO RESEARCH FOR AUSTRALIA WEATHER & CLIMATE

This covers Australia and the weather, understanding the weather, farming and the weather, air pollution and wind and the human environment.

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CSIRO RESEARCH FOR AUSTRALIA FORESTS AND THEIR PRODUCTS

Topics covered include plantations, usinfg Eucalypts for timber, bushfire, biology of forest products, rainforests forest pests and diseases as well as wood uses.

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CSIRO RESEARCH FOR AUSTRALIA CONSERVATION AND THE ENVIRONMENT

This book covers rainforests, managing wildlife and habitats,fire, parasites and diseases, arid lands, soils, the Tropics and Wetlands.

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This book describes step by step all stages of a revegation projexct.Planning, including a calender of activities, selecting species, collecting seed, preparing the site and after care.

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AUSTRALIAN FARMING THROUGH 200 YEARS ASHTON

This is a selection of documents and an introductory discussion of pictures as historical evidence.

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MODERN DEER FARMING MANAGEMENT

Contents include an industry review, the role of Deer, Deer farming calender, financial aspects, breeding and mating, velvet production, stock purchase and animal health and handling.

Pub. 1988 $29.95

CSIRO RESEARCH FOR AUSTRALIA WEEDS, PESTS AND PLANT DISEASES

Insect pests of crops, pests of grazing animals, vertebrate pests,post-harvest cereal pests, as well as plant diseases and weeds are covered in this book.

Pub. 1986 $9.95

CHANGING AGRICULTURE - WILSON

The aim of this book is to introduce the reader to systems concepts and processes. The author logically develops the case for systems thinking for the practical purpose of improving situations in agriculture. The book should prove of great benefit to secondary and tertiary students in agriculture and associated fields.

Pub APRIL 1988 88pp pb $12.95

Tillage

New Directions in Australian Agriculture

P. S. Cornish and J. E. Pratley (Editors)



In both crops and pastures the traditional methods of tillage are being swept aside. This book gives the reasons behind these changes and explains how to make them successfully. The authors describe in practical terms the options open to farmers as well as explaining the responses of soils and plants to tillage.

Topics covered include: the development of modern cultural practices; soil structure and conservation; plant nutrition; soil and plant water relations; crop residue management; the response of weeds, pests and diseases to changing tillage practices; the impact of changes on plant breeding; and methods of encouraging the adoption of this new technology.

This book is of great value to professional workers in agriculture as well as containing a wealth of information for up-to-the-minute farmers and students of agriculture.

456 pages 250 mm x 176 mm limp 16 b/w photographs 69 line drawings 109 tables 1987
ISBN 0 909605 42 4

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R&D AQUAPONICS
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UNIT 4, 13-14 HALLSTROM PLACE, WETHERILL PARK SYDNEY 2164
P.O. BOX 238 GUILDFORD 2161 TEL. (02) 604-5788 FAX. (02) 609 4871

8 August 1991,

HYDROPONICS -A SCHOOL PROJECT

Attention: THE PRINCIPAL.

Dear Sir or Madam,

R&D AQUAPONICS has been involved with hydroponics for over 25 years and are familiar with all aspects of hydroponic systems and growing of indoor plants and commercial crops. We are undoubtedly a leader in this field, and we have three books published in Australia on the subject. We have setup a research facility to assist us in furthering our technology and the development of further expertise.

We would like to offer you and your staff our experience, equipment, and open our facilities to your school. In the book "BASIC HYDROPONICS FOR EVERYONE" by J. Romer we have devoted a section to HYDROPONIC PROJECTS. This discusses and explains simple systems, how to set them up, how to get meaningful results, and how to carry out statistical analysis of the results for advanced students. We find that a lot of emphasis in teaching is placed on the more complex systems, whereas most growers use more basic simple systems. Hydroponics is simple provided the basics are understood.

At our research facility we are investigating a range of growing medias and systems to be used by the home grower and the commercial grower. This facility is designed to be a semi commercial operation which pays for itself and is something that the school may look into as a self supporting venture as well as a training and educational facility. Class visits to our facility are welcome by prior arrangement.

We supply a wide range of equipment and items for hydroponics. While these are not all included in our product and price list we would be pleased to discuss your requirements in detail and help you set up your own hydroponic system. We offer a ten percent discount off the prices in our price list to schools where an official order is received.

If we can be of assistance, then contact us.

J. Romer BSc BA Hort Cert.

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HYDROPONICS:

by J. ROMER BSc BA Hort Cert.
R&D AQUAPONICS.

Hydroponics is growing plants in an aerated nutrient solution of plant nutrients. Many systems use an inert growing media to support the plant. Other systems use a flow of nutrient solution where the plant is held from above.

WHAT CAN YOU GROW:

Any plant that will grow in soil can be grown in hydroponics. This includes trees, shrubs, vegetables, herbs, bulbs, flowers, and indoor plants.

All plants require the same basic requirements such as light, carbon dioxide, water, nutrient salts, root aeration and warmth.

Some of the major crops grown in hydroponics includes lettuce, tomatoes, cucumbers, strawberries, roses, carnations, and herbs.

HYDROPONICS CAN BE SIMPLE:

Hydroponics can be as simple as placing a polystyrene foam float on a nutrient solution, cutting a hole in the foam to hold the plant (such as a lettuce), and suspending the roots in the nutrient solution.

It can be as simple as using a tray filled with a growing media such as perlite to support the plant, and feeding the plant on a regular basis with nutrient solution.

A major part of any hydroponic system is the plant food or nutrient, because these are essentual for lush healthy growth. This nutrient solution must be complete and contain all the major and minor elements for growth, and these must be in the correct proportions. The other essentual is good root aeration or supply of oxygen for the roots to carry out their functions. Provided the plant recieves all its other requirements of light, carbon dioxide from the air, moisture, and warmth it will grow.

Hydroponics allows the plant to grow at its best and develop unencumbered.

WHY HYDROPONICS:

Hydroponics takes the backache out of growing.

The major advantages of hydroponics over soil growing are:

a) Crop yields and plant growth are consistent.
b) There is no weeding, hence fewer diseases and pests.
c) Insect pests and diseases are reduced.
d) Crop yields are higher. A lettuce grower in hydroponics can produce ten crops per year as against two to three crops in soil.
e) Faster turnaround of crops ie replant immediately.
f) Easier to harvest eg waist height.
g) Low maintenance.
h) Environmentally sound ie uses minimum of nutrients and water, and is not harmful to streams or rivers.
i) The grower has greater control over the final produce quality.
j) The vegetables have more flavour and nutrition - not deficient in essentual salts.
k) The initial costs are similar to setting up for soil growing, and less land is required to grow the same volume.
l) It is an intensive form of Agriculture and crop protection is justified (eg greenhouse production).
m) It is easier to get suitable labour for harvesting and working on the crop.

HYDROPONIC NUTRIENTS:

A hydroponic nutrient is not just another fertiliser. It must be complete and contain all the major elements such as Nitrogen, Phosphorous, Potassium, Calcium, Magnesium, and Sulphur and the minor or trace elements such as iron, manganese, boron, zinc, copper, and molybdenum that the plant needs for growth.

More importantly these elements must be in the correct proportions or combination to give total and complete growth of the plant. This means root growth, leaf and foliage growth, and flower and fruit development.

Some people think that hydroponics is growing plants using chemicals. If you consider sea water as a chemical then hydroponics uses chemicals. Hydroponics uses the same nutrient salts that are found in nature and that the plant would obtain from any fertile soil. They are as natural as salt and sugar. Plants in soil cannot use organic matter until it has been decomposed by bacteria and fungi into its natural salts. In fact the roots of hydroponic plants have a very clean earthy smell to them.

In soil all the essentual elements may not be available resulting in patchy growth, stunted growth, or discoloured. Plants grown hydroponically are more nutritous because they have the complete balance of their requirements. The grower has greater control over texture and flavour of the produce and the development of colour and perfume in flowers.

With hydroponically grown plants the root system is generally smaller because the plant does not have to search for water or nutrients. As a result the plant puts its effort into producing the saleable item such as the flower, the fruit, or the foliage, or into the food storage organs such as carrots and onions.

Hydroponics is more environmentally friendly because it requires less water and nutrients thus conserving our natural resources. It is non polluting in the way that fertilisers and decomposed organic matter used in soil growing become washed into our rivers and streams. The nutrient salts used go into the plants and not into streams and creeks.

HYDROPONIC GROWING MEDIAS:

The majority of commercial hydroponic growers use a growing media to support the plants. The media used can be chosen from a wide range of inert materials such as sand, fine gravel, perlite, vermiculite, scoria or volcanic rock, pumice or plastic beads. They have different properties, availability, and costs.

Medias such as gravels and sands are very heavy, poor water and nutrient holding capacity, they can become very hot on hot days. They are used mainly where the nutrient is pumped through on a regular basis and recirculated. Their major advantage is their low cost.

Medias such as Perlite and Vermiculite are lightweight medias, high in water and nutrient holding capacity, are slow to heat up and cool down. They are ideal for simple home systems and are used commercially where the nutrient solution is not recirculated.

Some of the properties that are sought in a hydroponic growing media include:

a) lightweight or not heavy to cleanup or setup the system.
b) inert and not contain soluble salts, etc.
c) free of diseases and pests.
d) consistent in particle size.
e) thermally insulating or heat up and cool down slowly.
f) have good waterholding capacity to suit the operation.
g) Stable and not breakdown over time.

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COMMERCIAL PRODUCTS PRICE LIST 15 MAY, 1991

				APPLICATION & USES
TOTAL GROWTH LIQUID NUTRIENTS:				
	1 OFF	5 OFF	10 OFF	FOLIAR OR LIQUID FEEDING
25 LITRE	$85	$58	$55	FLOWER OR VEGETATIVE NUTRIEN
CUT FLOWER FOOD & PRESERVER			NATURAL WAY	
25 LITRE	$58	$50	$47.5	Used at rate of 5 ml/L water Preserves cut flowers
BUGOFF	NATURES WAY			
25 LITRE	$58	$50	$47.5	Used to repel and eliminate insect pests (mites, aphids)
TOTAL GROWTH POWDER NUTRIENTS - HYDROPONICS OR SOIL				
	1 OFF	4 OFF	10 OFF	
25 KILO	$75	$50	$45	GP, Solufeeds, Specials, or single or two pack systems
NFT CUPS - to hold seedlings & plants:				
	1 box	2 boxes	4 boxes	Specially designed for lettuce
box 25,940	$30/1000	$28/1000	26.50/1000	and strwby using NFT systems
GROMESH - to hold strawberries in NFT channels.				
		1 roll	10 rolls	An open weave material used
25m long 75mm		$0.90/m	$0.65/m	to support plants in NFT pipe
120mm		$1.60/m	$1.05/m	
pH & Conductivity Meters:				
pocket units with LED display.				$105 per unit
pH & Conductivity Standard Solutions:				Used to standardise instrument
1 litre	$20			
AQUAFLUTE CHANNELING - troughing				Used to form troughs, beds or
ROLLS 50m	1 OFF	4 OFF	10 OFF	channels (tomatoes, carnations
	$250	$220	$210	cucumbers, capsicums, etc
PVC CHANNELS & PIPING:				Used for lettuce, strawberry,
6m	prices on application			herbs, tomatoes, cucumbers
SYSTEMS DESIGN to suit your application				
	price on application.			

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	PRICE	WEIGHT	APPLICATION & USE
HYDROPONIC NUTRIENT SOLUTIONS:			
250 ml INDOOR PLANT	$5.80	0.5 kg	used for indoor plants
250 ml AFRICAN VIOLET	$5.80	0.5 kg	special African Violet
1 Litre GENERAL PURPOSE		1.5 kg	general or vegetative form.
5 Litre GENERAL PURPOSE	$39	6 kg	All nutrients solutions
5 Litre SPECIAL FLOWERING	$39	6 kg	complete and balanced.
Offers convenience and simplicity for the home grower.			
HYDROPONIC NUTRIENT POWDER:			
1.5 kg	$11.50	3 kg	Available as general purpose
5 kg	$28.50	6 kg	vegetative or flowering form
25 kg	$85	27 kg	Use 2 grams / litre water.
Used by the larger home grower.			
HYDROPONIC GARDEN KIT:			
1 off	$50	10 kg	Polythene tray, perlite mix
5 off	$45/kit	35 kg	1 litre GP mix, instructions moisture indicator.
GROWING SUPPORT MEDIA:			
PERLITE/ Vermiculite Mix			
TOPUP PACK 15 Litre	$12.50	4 kg	small pack topup.
STARTER PACK 50 litre	$25	10 kg	
BULK PACK 100 L	$38	15 kg	
PERLITE	$38	15 kg	
VERMICULITE	$45	15 kg	
EXPANDED CLAY			
2 litre	$8	5 kg	Used for hydroculture and
5 litre	$16	7 kg	for flood & drain, ebb and
80 litre	$100	35 kg	flow systems.
BUGOFF			
250 ml	$5.80	0.5 kg	A garlic based insect
1 litre	$15	1 kg	repellant & eliminator.
PROPAGATION:			
PROPAGATION BLOCKS (5 off)	$20	1 kg	Rockwool 32 squares/ block.
PEAT POTS (10 blocks)	$20	1 kg	12 pots per block.
PROPAGATION KIT	$20	5 kg	tray,nutrient,rockwool block
PROPATION KIT WITH LID	$35	7 kg	Kit plus lid and two sizes of rockwool blocks.
BOOKS:			
BASIC HYDROPONICS	$18	$3 post	Both are exceptionally good
HYDROPONIC GARDENING	$21		introductory books.
BOOKLET:			
HYDROPONIC STRAWBERRY GROW	$20	$3 post	For commercial growers.

SPECIAL HYDROPONIC SYSTEMS ARE AVAILABLE eg EBB & FLOW, GROWING LIGHTS, ETC.

ADD FREIGHT COST, HANDLING CHARGE ($5), and include cheque, bankcard, or mastercard number. Also NAME, ADDRESS, TEL. No, RAIL STATION.
RAIL COST: $16 for the first 5 kg, and $4 for each 5 kg thereafter.

Here is your chance to express your opinions , REMEMBER this is a publication for you and ALL information is important . It may save alot of work for a fellow AGGIE .

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Thankyou for your support .

Ian Saunders
Editor

Address - Dunheved High - Locked Bag 6 , St Marys 2760