Answers to
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OF AGRICULTURE TEACHERS

B. A. A. T.

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SECTION I

Attempt ALL questions

Recommended time - 40 minutes

QUESTION 1.

The following questions are about a plant you have grown.

Name of plant Grain sorghum

Region where plant is grown North West N.S.W.

Examiner's use only

(a) Figure 1 on page 3 shows the key points of the production cycle of any plant.

Fill in figure 1 for the plant you have grown by answering questions (i) to (iv).

At the numbered spaces on the diagram in Figure 1:

(i) List three activities needed for preparation and planting. 3

(ii) List one input used in planting. 1

(iii) List a different input you used during plant growth. 1

(iv) List one management practice carried out during plant growth. 1

NOW

(v) Name the month(s) of planting and the month(s) of harvest/use.

Must name months or season, e.g. spring, for each mark. If at all possible to plant crop in named month for the region then answer accepted. 2

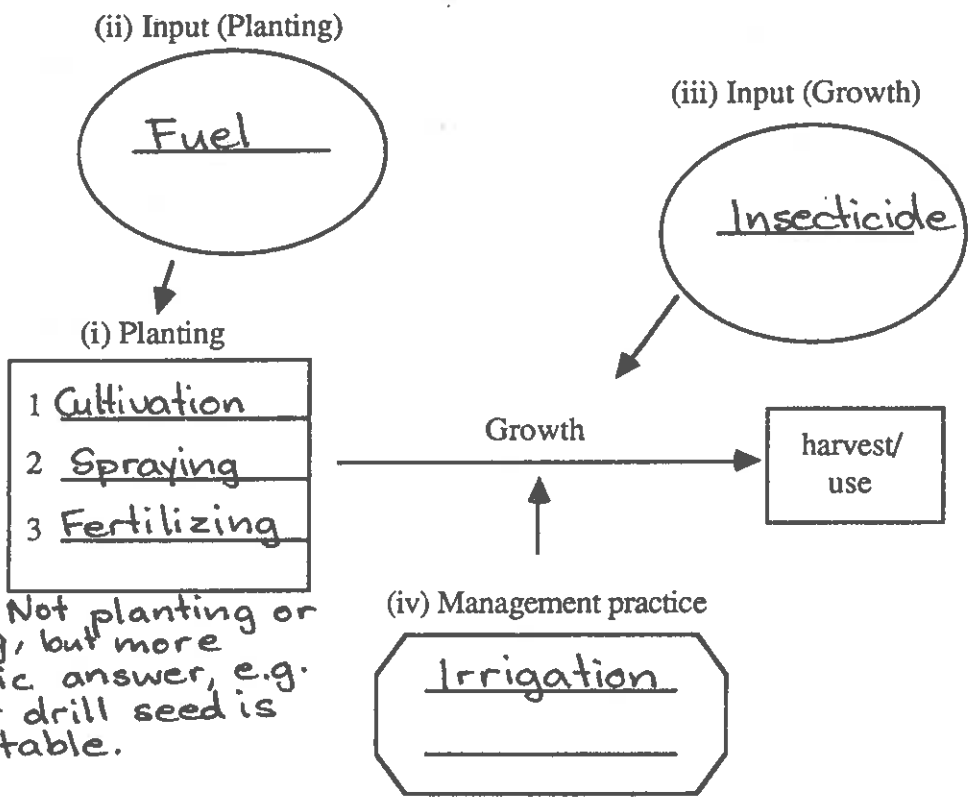
(vi) Name the month(s) when you carried out (iii) and (iv) above.

If at all possible to carry out (iii) and (iv) in named months or season then answer accepted. 2

10

Examiner's use only

Figure 1. Crop production system



Not planting or sowing, but more specific answer, e.g. direct drill seed is acceptable.

(viii) Explain why (iii) and (iv) were done at the time you indicated in question (vi).

(iii) 1 mark for explaining why e.g. high level of midge infestation... 2 marks for including reason for problem occuring then e.g. higher temperatures encouraged increase in midge population... Vague statements, e.g. "pests attack plants" = 0

2

(iv)

2

(vii) Briefly state how you decided when to harvest or use the output of the plants.

For 1 must show understanding of what grower looks for... Just saying "when plants are mature" = 0. A good example is "tomatoes - orange/red colour on base of fruit.

1

5

Examiner's use only

(b) (i) Name ONE environmental factor which affects the rate of growth and development of your plant.

Any environmental factor accepted. Genetic factors not accepted.

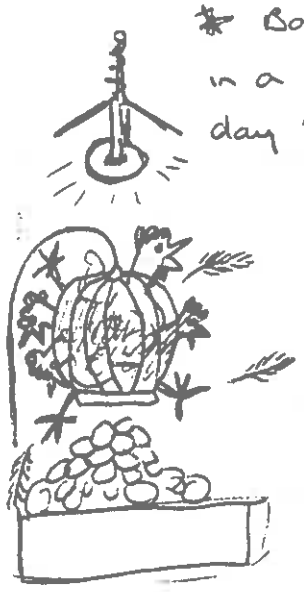
1

(ii) Explain how this environmental factor affects the growth and development of your plant.

Explaining how environmental factor affects some process in plant = 1 e.g. linking moisture supply to photosynthesis. For 2 marks process must be linked to growth and development For 3 marks must explain specifically how the environmental factor affects growth and development, i.e. more than just a brief or vague link.

3

4



* Battery hens are used for eggs - 4 birds in a budgie cage forced to lay 2 eggs a day 'cause light shines on them.

Examiner's use only

QUESTION 2.

The following questions relate to a farm you have studied.

(a) Describe ONE problem or limitation which was found in an animal production system on the farm.

Name of animal production system 0

Description of problem 1 mark for naming problem, e.g. disease, environmental, managerial. 1 mark for short description. 2

(b) How was the problem identified? Adequate description of identification criteria, e.g. symptoms of disease, affects on production, changes in physical make up of animal. 2

(c) Outline one management practice which was used to reduce or remove this problem.

2 marks for clear description of management practice, ... e.g. vaccination, drenching, adjusting nutrition, grazing management. Marks awarded for clear knowledge of management practice of an inappropriate example, i.e. soil, pasture problems. 2

(d) Explain how effective the management practice was in overcoming the problem.

1 mark for stating how effectiveness was gauged and 2 marks for explaining how the management practice was effective, the influence it had on future production trends and other management practices that could be adopted to counter ongoing problems. 3

(e) Explain how you could compare the productivity of the animal production system named in (a) above with that of similar production systems on other farms in the region.

2 marks for 2 clearly stated methods of comparing productivity, e.g. feed conversion ratio, kg wool / head etc. 2 marks awarded for one example with a clear explanation, e.g. gross margin, partial budget. 2

11

Examiner's use only

(ii) Describe the difference in the pattern of growth of the two sets of pigs.

Both farms had the same growth until weaning after which pigs from farm X grew better than pigs on farm Y.

(iii) List THREE possible reasons that could account for this difference.

Different breeds of pigs
Different nutrition
Different management - disease control
- housing

(c) Both farmers mix their own feeds. Farmer Y used a mix based on grains (wheat, barley, oats and soybean). Farmer X used these grains with added meat meal. Both diets had a crude protein level of 20%. State TWO reasons for using this protein level, rather than a higher or lower level.

This is the recommended level for young growers.
Any more would be uneconomic.

(d) The local district pig officer of the Department of Agriculture, gave Farmer Y the data shown in table 2.

Table 2. Daily weight gain in pigs

Grain plus meat meal ration		Grain ration	
Added minerals	No added minerals	Added minerals	No added minerals
495 g	496 g	496 g	296 g



breeding cycles.

Examiner's use only

(i) What conclusions could you draw from this experimental information?

Meat meal contains minerals. Minerals and meat meal enhance a grain ration.

(ii) How could Farmer Y test whether the conclusions from this experiment would provide an answer to the growth rate problem shown in table 1?

Randomly selecting three groups of 10 pigs. Feed Group 1 Grain only (control) Group 2 Grain + minerals Group 3 Grain + meat meat. Monitor and compare after five weeks from weaning.

(e) Both Farmers X and Y have different solutions to their other major problem of waste disposal. Farmer X uses anaerobic ponds, and Farmer Y uses aerated ponds. Both involve breakdown of organic matter by microbes.

(i) How are these two systems different?

Aerobic microbes use oxygen, anerobic microbes do not use oxygen

(ii) Compare the way the microbes break down the organic matter in the two waste disposal systems.

Aerobic microbes oxidise organic matter with oxygen. Anerobic microbes ferment O.M. in the absence of oxygen.

(f) The outputs of both waste disposal systems are sprayed onto grazing paddocks. Outline TWO effects on the paddocks of adding such material.

1. Increased level of minerals in soil leading to increased pasture growth.
2. Increased O.M. levels in soil leading to increased water holding capacity.

Examiner's use only

QUESTION 4.

The text below is a case study taken from a farmer during an interview with a farm management advisor. Read the text then answer the questions which follow.

> Pesticide residues were found in the carcase of a grazing animal sold for slaughter to an export meat company. The farmer was told about this by his agent who also told him he would not be paid for the animal which had been sold for $450. The report quoted a high concentration of dieldrin of 0.4 mg/kg. Dieldrin is a chlorinated hydrocarbon pesticide used for killing insects which lasts for a long time in soils.

(a) Write out TWO questions the advisor might ask the farmer when trying to discover how the animal became contaminated.

(i) Have you ever used Dieldrin sprays on your property if so at what concentration?

(ii) Do any of your neighbours use Dieldrin pesticides and is there anyway it could have got onto your farm?

(b) A soil test on one of the farm's paddocks showed a high concentration of dieldrin. Describe ONE way in which the soil could have become contaminated without the farmer knowing about it.

A previous owner of the property may have used sprays and contaminated the soil without the present owner ever finding out about it.

(c) Pesticides such as dieldrin can remain in the soil for many years. Describe two ways the farmer could manage the problem if pesticide residues were discovered in the farm's stock.

1. Test the whole farm for contamination and graze the rest of the stock of uncontaminated areas to prevent further build up. 2. Grow or run an alternative enterprise which will not be used for food eg sheep for wool, cattle for breeding, trees for timber, ornamental flowers.

Examiner's use only

(d) The Government has stepped into the market system and does not allow the sale of food products containing pesticides above certain levels. Explain why the Government has taken this step.

To prevent pesticide levels building up in the consumers tissues and ensure their good health and to ensure that we maintain our overseas markets which will ban contaminated products

(e) Describe TWO possible socio-economic effects of the contamination on farmers and the farming community.

If the farmers stock is contaminated he can not sell them for meat and his income will fall. Consumers may stop buying meat in fear of contamination so demand drops and prices will fall and all farmers will receive less money

(f) Farmers frequently use chemicals to improve productivity, but their use has led to problems.

(i) Explain how producers have changed their approach to pest control as result of problems such as environmental pollution or pest resistance.

Producers now want to use safer methods and less chemicals. So they are turning to alternatives such as biological control, cultural control & genetic control combined with careful chemical use.

(ii) Describe TWO factors which may influence farmers' decisions to use chemicals.

1. The cost of the chemical and whether this is greater than the cost of lost production.

2. Chemicals may be more effective, easier to use and faster acting than any alternative method.

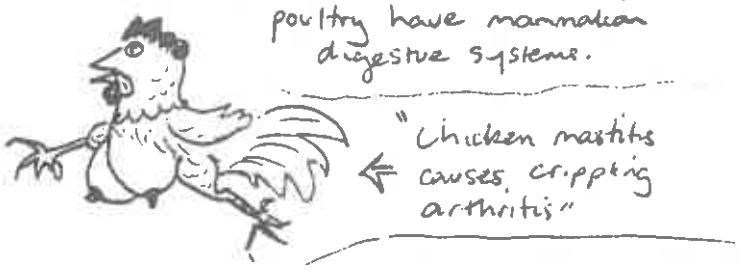
Examiner's use only

(iii) For an agricultural production system with which you are familiar, outline how a pest management program is operating and evaluate its effectiveness.

Blowflies on sheep are controlled by mulesing, crutching, jetting or dipping with insecticides, using less wrinkly, resistant breeds. An integrated use of all these things is very effective except under prolonged hot wet conditions where losses still occur.

(iv) Explain how pest resistance to insecticides occurs.

When sprayed some insects survive and these breed resistant offspring which will survive and breed



Examiner's use only

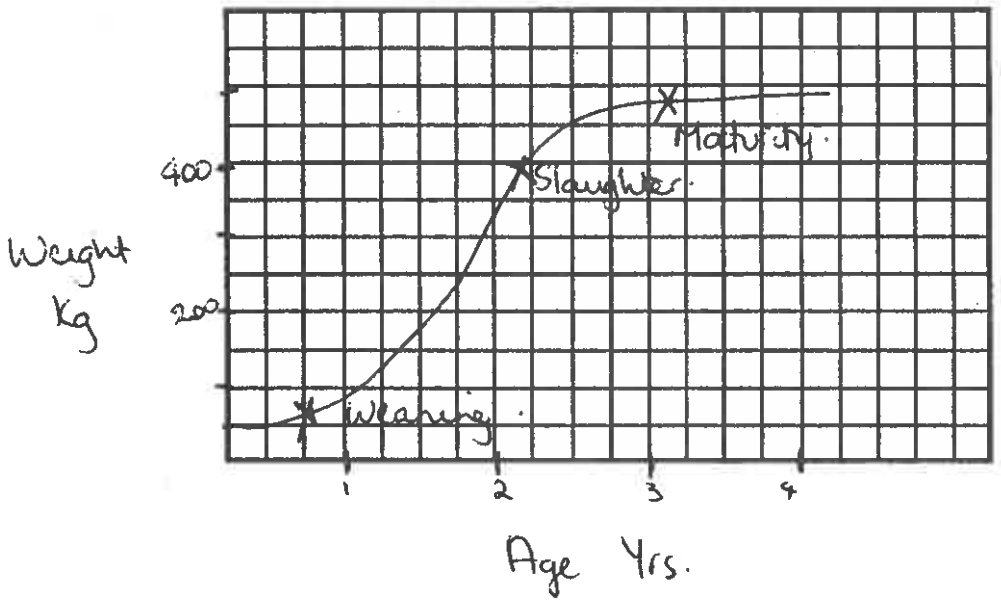
QUESTION 5.

(a) The following questions relate to an animal you have studied.

(i) Use the axes provided below to draw a growth curve for a farm animal you have studied.

Type of animal studied ..... Beef Cattle - Vealers .....

Take particular care with the labelling of the axes and the scales used so that you can demonstrate your knowledge of the growth and development of the animal.



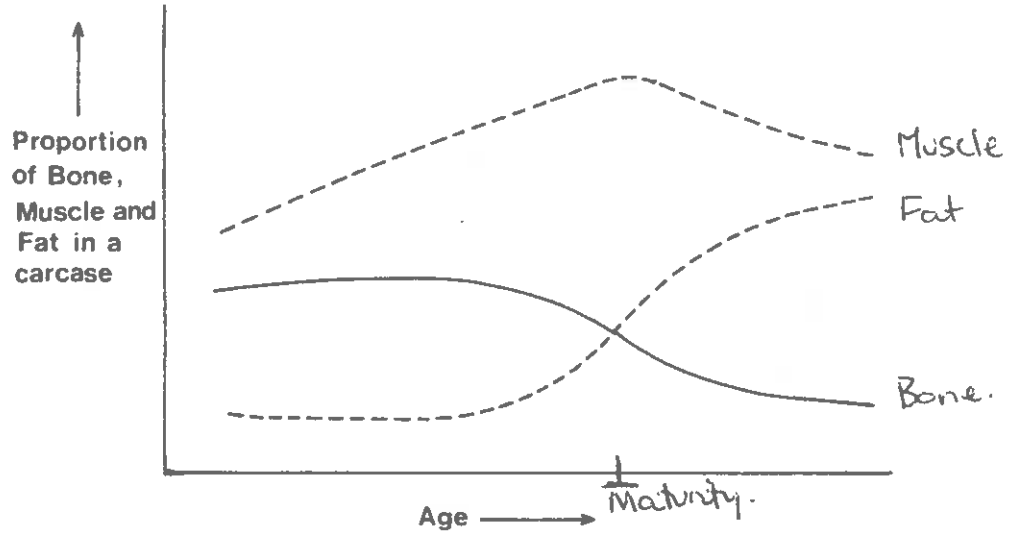
(ii) Mark and label on your curve the time at which THREE of the following events would be likely to occur:

* change in ration fed to animal
* weaning
* puberty
* maturity
* slaughter
* vaccination
* castration

Examiner's use only

(b) (i) Label the curves on figure 5 to show which represents bone, muscle and fat.

Figure 5. Changes of tissue in the carcase of an animal



(ii) Label the age axis to show the point of maturity of the animal.

(iii) Explain why you marked this age as the point of maturity.

Where muscle development gives way to fat; the proportion of muscle decreases & fat increases

(iv) How does the information presented in figure 5 affect a producer's decision about what ration to feed the animal?

Early needs high protein for growth and development and high energy to enable production of muscle. After maturity ration changes to maintenance to avoid fat deposits

(v) Consumer demand for leaner meat has led to the breeding of animals with leaner carcases. Explain how a farmer might breed animals with leaner carcases.

Selection of lean parents - line breeding... progeny testing of carcase fat levels

Examiner's use only

(c) (i) For a product you are familiar with, either describe OR illustrate using a graph or diagram how the supply, demand and price have changed over a period of time.

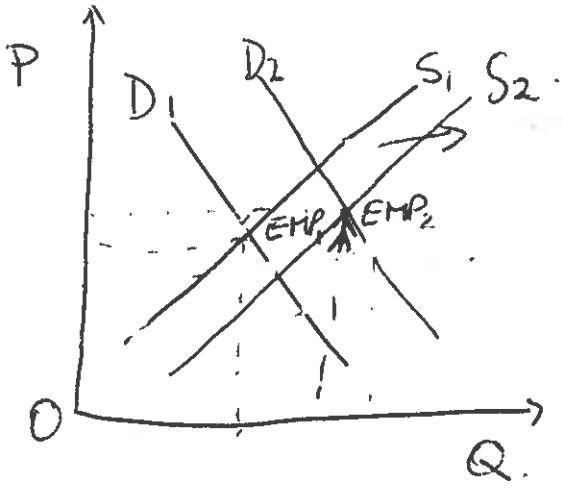
Name of product: Beef

Period of time: late 1980's

Description of changes: .....

.....

.....



EMP = Equilibrium Market Price.

(ii) Describe some of the features of the market which caused the changes you outlined in (i) above.

Price has increased due to increased demand from overseas market eg. JAPAN.

Examiner's use only

(iii) Explain how you think a change in supply of an alternative product could change the market.

Alternative product eg chicken had increased supply, price would decrease and consumer would buy less beef

(iv) Outline TWO ways in which farmers and marketing groups can attempt to influence demand.

1. Advertising of beef eg 'Feed the man meat'
2. Improve quality of product eg produce 'lean' meat



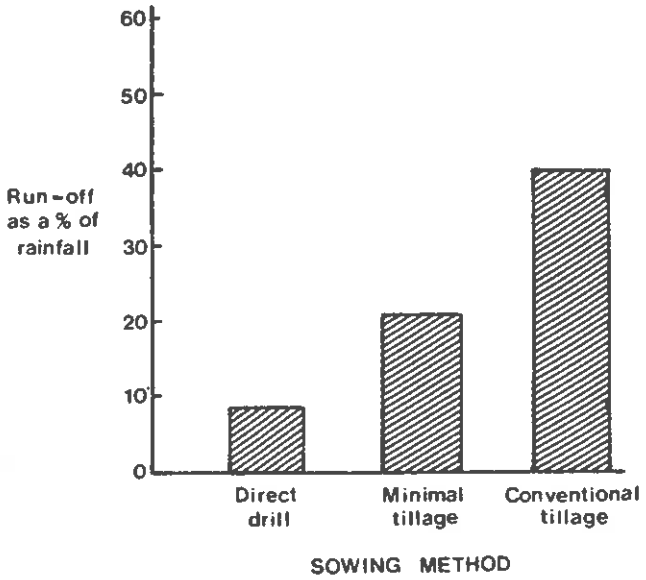
Rape is grazed at night because it attracts the sun & burns the sheep

Examiner's use only

QUESTION 6.

(a) Figure 6 shows rainfall run-off from a rainstorm of 28 mm which fell in 20 minutes.

Figure 6. Run-off in relation to sowing method



Note: Conventional tillage used at least three cultivations before sowing.
Minimal tillage had one cultivation before sowing.
Direct drill had no cultivation, and used sprays to control weeds.

(i) Direct drilling gave the lowest amount of run-off.
What should this do to the level of stored water in the soil?

INCREASE THE LEVEL OF STORED WATER

(ii) List TWO other factors which affect the level of stored soil water.

SOIL STRUCTURE, SOIL STRUCTURE, LEVEL OF O.M., VEG. COVER, EVAPORATION

(iii) Outline ONE other consequence to the soil when high run-off occurs.

SOIL EROSION (1) that carries away top soil resulting in nutrient losses. ✓

Examiner's use only

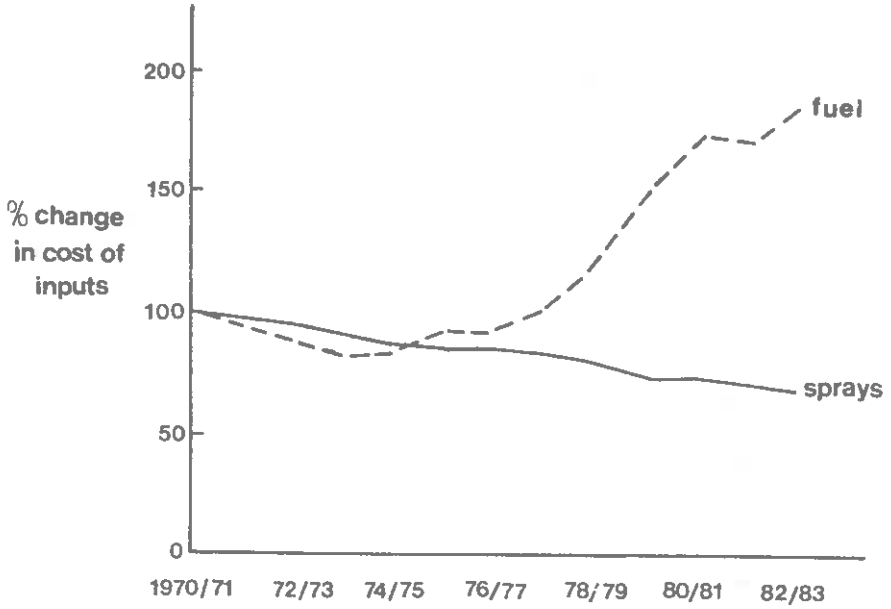
(iv) Discuss ONE advantage and ONE disadvantage which may follow a change to direct drilling.

1. IMPROVED SOIL STRUCTURE due to reduced cultivation. IMPROVED W.H. capacity

2. INCRESED COSTS of purchasing new machinery.
BUILD UP of chemical residues.

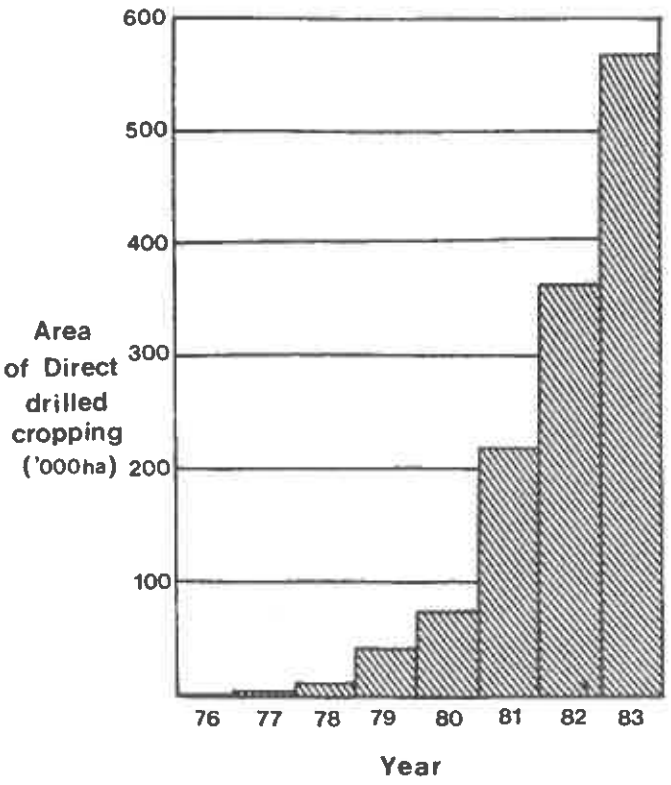
(b) Figures 7 and 8 relate to the use of direct drilling (a reduced tillage system) in cropping.

Figure 7. Percentage change in costs of inputs



Examiner's use only

Figure 8. Total area of direct drilled cropping



(i) Explain the reason for the changes represented in figure 8, using the information provided in figure 7.

The area of direct drilled cropping has increased as fuel prices have increased and spray costs have decreased

(ii) Despite the trend shown in figure 8, most of Australia's cereal crops are still sown using traditional techniques.
Explain why this is the case.

It is very hard to re-educate farmers
expense of new machinery
higher germination rates.

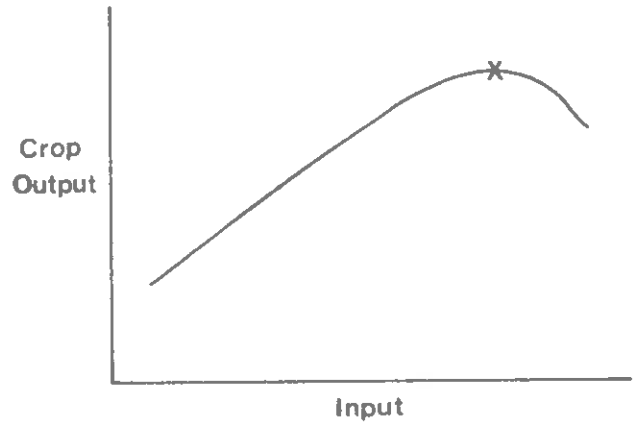
Examiner's use only

(iii) How does an individual farmer decide which alternative methods to use when faced with the sort of information you have provided in (i) above?

By constructing a partial budget for the 3 methods he can decide which is most profitable, labour saving and suitable.

(c) Crop outputs can be affected by changing the levels of inputs. This is illustrated in figure 9.

Figure 9. Crop output and input in agricultural systems



(i) Describe what occurs at point x.

Maximum biological yield (2) maximum output (1)
crop yield

(ii) Explain whether this is the level of input a farmer would use.

This is NOT the level of input used. The level used would be where MC = MR; profit is maximised and least cost achieved. Level of input would be left of x (candidates indicated this on graph).

Examiner's use only

(iii) The adding of inputs can improve production, but it also adds to the chance of increased financial losses due to factors outside a farmer's control. List THREE such factors which can affect agricultural systems.

climate variations, due to price, in demand
pests and disease
govt. intervention.

(iv) Explain TWO ways in which farmers manage risk in their production system.

1. Diversification - 2 or more enterprises e.g.
2. Contracts - giving guaranteed prices.



Death - a tell-tale sign of beat.

GUIDE LINES FOR AN EMBRYO TRANSFER PROGRAMME. Page one.

This information is intended to cover most of the steps involved in arranging an "on-farm" embryo transfer programme and to provide some more technical information for a basic understanding of the processes. There are three major tasks to be done before the day of embryo transfer.

1. Preparation of the DONOR or stud cow/heifer including SUPEROVULATION.
2. Preparation of the RECIPIENTS or host cows/heifers or SYNCHRONISATION.
3. Preparation of the FACILITIES to be used for recovery and transfer of embryos.

1. THE DONOR.

The cow or heifer from which the embryos are to be recovered ("flushed") is called the DONOR.

The donor must be having regular heat cycles , preferably predictable and not short or irregular. Some cows not seen on heat since calving at 45 days or old cows may be used with suitable preparation. This involves an examination of the ovaries for signs of heat and perhaps use of PROSTAGLANDIN to bring on a heat. Signs of a recent heat are a palpable corpus luteum on the ovary. This structure is the yellow body or gland that grows in the cavity left after ovulation or release of the ovum (egg). Previous problems such as not holding in calf or retaining membranes may affect the response to the hormones. It would appear advisable to have such cows examined for signs of infection and an irrigation can do no harm.

SUPEROVULATION or multiple ovulation (release of more than the normal one ova) is caused by the injection of hormones . Normally only one of a number of developing follicles in the ovaries receives enough hormone to complete ripening and shed the ovum at heat. The remainder die off and are lost for ever. The extra hormones given in the period leading up to the next heat will cause these other follicles and more to grow to completion and hence release ova when the heat occurs. PROSTAGLANDIN will induce heat in cattle if given to cows that are 5 or 6 days after heat up to 16 days after heat by destroying the corpus luteum that prevents the heat from occuring. Thus PG may be used to bring on heat when planned when the induced follicles are ready to release their ova.

There are two hormones commonly used to stimulate follicle growth: PMSG (PMS) or Pregnant Mare's Serum Gonadotrophin which is an extract from serum of pregnant mares and FSH-P (FSH) or Follicle Stimulating Hormone which is an extract from the master gland, the pituitary gland. Both come as powders in the refined form and are costly drugs which must be used carefully and as directed.

...../2.

PMS is given as one injection into the muscle as it lasts for about five days in the body. FSH only lasts for a short time and must be given twice daily for four days into the muscle. PG is given a few days after first treatment to allow the follicles to successfully ovulate when the cow comes into heat. The ovaries are palpated before collection and the number of corpora lutea able to be felt will indicate approximately how many eggs were ovulated. Usually both ovaries will release a similar number of eggs.

The number of ripening follicles in the ovaries of a normal cow appears to be influenced by the body condition of the animal over the previous 3 to 6 months or longer. The greater this activity in the ovaries then the better the response to the hormone treatment (FSH or PMS). Active ovaries appear to be present in cows in ordinary store condition with no internal body fat. It takes months of good feed to allow this channel fat to build up and as long to remove. The cow that is adequately fed and made to earn her living or made to work will not put on fat internally,or if she does so during late pregnancy then it is important to use these reserves in the first few months of lactation to maintain active ovaries. There are exceptions, but this may explain why dairy cows give better results in general than heavier beef cows, and why a beef cow does best soon after calving or in drought conditions although holding in good store condition, and possibly why 3-4 months starvation for heavy condition beef cows or dry dairy cows can turn a poor responding cow into one that produces results. Simply put, roughage makes for a metabolism suitable for active ovaries and concentrates make it easy to get energy for fat build up and a lazy system. A balance with the cow's requirements must be sought. These trends are not necessarily true for young or immature females which appear to do best when growing rapidly but with enough feed to keep them moving.

The commonly used treatment plan is as follows:

1. Commence hormone treatment 9 to 14 days after last heat. This may be extended to 7 to 15 if need be.
2. Two days after PMS or on the fourth day of FSH injections, PG (prostaglandin) is injected. There are a number of PG's and all appear to be effective. Inject PG into the muscle, this is arranged with your own veterinarian.
3. Expect the donor to come into heat two days after PG. This will vary and may indicate the response as most cows with responses will be in heat during the second day, a few on the third day, a few on the evening of the first day after PG. Usually heat on the third day indicates a low result i.e. one to three ovulations.

...../3.

4. Mate the donor. Use natural service or AI. With natural service ensure a service occurs then remove the cow to be returned 4 to6 hours later for a repeat service. There is no one method to guarantee good fertilization results as there are still circumstances that affect fertilization that are beyond present control. If AI is used then ensure good technique, good timing , and good semen is used.

If there is no limit to the semen then use two straws at the normal time (10 to 12 hours after first standing heat) with half of one straw left just back in the cervix, and follow up 10 to 12 hours later with one straw all deposited into the uterus.

If only two straws are to be used then give one at each of the two occasions and again leave some of the first straw in the cervix.

One straw has often been used with success if the technique is good (do not handle the ovaries), semen good, and it is given at 18 hours after first seen in standing heat with some left in the cervix on withdrawl.

When repeat AI is used then BE CLEAN: have the vulva opened for you to place the gun so that manure is not taken into the vagina to contaminate the next gun used. AI late in heat must be clean as the uterus is more susceptible to infection then.

5. The donor is usually flushed seven days after heat induced during the treatment. Non-surgical collection may be performed from 6 to 16 days after heat but 7 is the usual stage with some done at 12 days. Only seven day old cow embroys may be successfully frozen. Heifers may proove difficult to collect non-surgically if their cervix is small because the catheters may not pass through easily. The long narrow uterine horns of beef cattle in particular may also reduce the efficiency of embryo recovery non-surgically. Most adult dairy cows give very good recovery rates ie. the number of embryos flushed out correlates well with the number of corpora lutea palpated on the ovaries.

After collection the donor is given an infusion, usually iodine, to prevent infection and stimulate return to heat, as well as ensuring that the donor does not stay in-calf should an unknown number of embroys be left. Multiple pregnancies do not give a good result because of the risk of abortion and if non-identical twins then a freemartin heifer. If PG is to be used after collection then 2 or 3 times the normal dose must be given to superovulated cows to get a result. Normally if the donor does not cycle within three weeks of collection then she should be examined for pregnancy and evidence of a heat, then given PG if there is doubt as to the stage of cycle. Donors to be repeat treated should be left for two heats before another attempt is made, and in this case PG may be given 12 to 14 days following collection to ensure a heat at the normal time.

..../4

The donor must be taken off full feed on the day of collection to ensure that the rumen is not full and in the way. The donor is given a tranquilizer if need be and a low spinal anaesthetic administered to paralyse the tail and rectum during the collection procedure.

Check that breed society regulations are covered. A blood sample may be required for blood typing and this can be arranged after a successful collection. Society forms are provided in most cases by the ET veterinarian.

THE TREATMENT SCHEDULE.

Commencing 7 to15 days after the last heat (which heat may be induced to fit the treatment dates) the hormone injections are given.

DAY	TIME	EVENT: FSH	PMS	
1	AM	1st FSH		
	PM	2nd FSH		
2	AM	3rd FSH	PMS	
	PM	4th FSH		
3	AM	5th FSH		
	PM	6th FSH	(PG recipients in afternoon)	
4	AM	7th FSH	PROSTAGLANDIN TO DONORS	
	PM	8th FSH		
5	AM			
	PM			* Heat check
6	AM		Expect donors in heat	* recipients
	PM		AI donors	*
7	AM		Repeat AI donors	*
	PM			*
.....				
13	AM	Recovery and transfer of embryos. This is one week after the donors were in heat.		

All treatments are given in the morning (AM) 6 to 9.00 am or evening (PM) 4 to 7.00 pm. Try not to miss treatments and keep regular times.

FSH doses will vary with the age and condition of the donor and total 30 to 50mg given over eight injections. PMS doses vary from 1800iu to 3000iu. FSH or PMS will be prescribed to be given, never both.

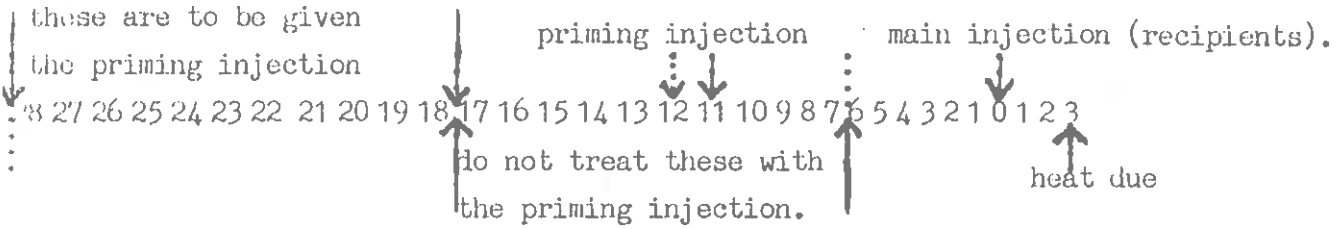
Please note all heats leading up to the month for treatment of the donor and have them handy for the organiser to obtain. The schedule is drawn up in advance of the heat before treatment so if heats are not as predicted please notify the organiser.

..../5.

4. THE RECIPIENTS.

The cow or heifer that receives the embryo is called the recipient. Heifers and cows that are not in calf and are cycling may be used, and milking cows are suitable if in joining condition.

These females must be grouped to cycle on or very close to the day that the donor cycles following hormone treatment, but do not need to be cycling with the donors before treatment. If their heats are not known then a two shot prostaglandin programme is used to synchronise their heats. Some expense is saved if the heats are known as those in heat 17 days/to 7 days before the main injection need not be treated/twice, with those in heat 28 days to 18 days before requiring a priming injection 11 days before the main shot.or 12 days if/more convenient.



The recipients will take from 2 to 5 days to come into heat after the PG injection with a peak at 2½ days. The donors will usually come on earlier than this, ie. 2 days, because of the hormone injections. Thus the recipients are treated in the afternoon before the day the donors receive PG.

Commencing the day before the donor is due in heat, carry out heat checks on the recipients twice daily or more if particular recipients are suspected of being in heat but not standing. The best times are early morning and late afternoon. Record the identity and the date and time (AM or PM will do) for each recipient seen in heat or if agitated, riding others etc. but not "on".

Conception rates for surgical flank transfer are usually over 60% and for good embryos are 70+%. Surgical transfer is carried out via an incision in the flank on the same side as the ovary that shed the egg in the recipient. Non-surgical transfer rates have improved to a very good level in the hands of experienced operators and may be the method of choice for transfer. Check with your EF veterinarian. The method used may depend upon the facilities, the type of recipient and the quality of embryo to be transferred.

The number of recipients required will vary with the number of embryos recovered. Usually 3½ embryos are transferred per donor TREATED, for pregnancies. This includes nearly 40%of donors that produce no result either because they fail to come into heat, produce no embryos or unfertilized embryos. Thus the 60% that respond produce nearly 6 transferable embryos each. Generally 10 to 15 recipients will need to be treated for one donor, 15 to 25 for two or three donors.

...../6.

. THE FACILITIES FOR DONOR COLLECTION AND RECIPIENT TRANSFER.

The donor is restrained for collection with clear access to the rear as for AI. The front legs of large cows may be elevated 8 to 10 inches to facilitate the handling of the reproductive tract. A firm stand of blocks or timber is enough. The area must be sheltered to allow for all types of weather.

A clean room or area nearby is used for searching and handling of the embryos. This must be able to be heated to 20° celsius (65° F) on cold days. A firm table and seat are needed for the microscope work. Power must be available to the microscope, and crush if surgical transfers are to be done.

For surgical transfer of embryos the recipients must be restrained in a suitable crush with access to the left and right flanks for preparation and surgery. Shelter may be needed from the sun and weather. A good lead up race will streamline handling of recipients on the day. Dairy cattle may be done in suitable walk-through bails, as long as there is a head bail to prevent movement and turning.

4. GUIDE LINES TO INSEMINATION OF THE DONOR.

As previously mentioned, the donor will usually come into heat during the second day after PG was given. With the FSH treatment, some donors will not be in season until that evening or less often the next morning, and still produce more than one or two ovulations. With PMS the donors not in heat until the third day generally only have one ovulation. There is no way of predicting the result and semen doses used may be reduced for those late on heat.

Some heifers and few cows may show no signs of heat at all on the day they are due. The best approach for these donors is to examine the ovaries for a size increase in the afternoon of the due day. They may be AI'd that evening and an idea of what is their status may be had by how they feel to AI. If they show signs of coming on that evening then wait until the next morning to see if they come on before attempting an AI. Should the donor come into heat on the third day then they may be AI'd and recovery of the one embryo attempted on the scheduled day of collection. Cows in heat only 5 days before collection will only have a single embryo and this may or may not be recovered.

. EMBRYO FREEZING.

Recent knowledge in the area of freezing bovine embryos indicates that selected normal embryos may be frozen with good success, almost equal to that of the average conception rate for fresh transfers (60%). The success overall will usually be less than that of fresh transfer because of the age and quality of the embryos. Check with your ET veterinarian about this.

-oOo-

INSTRUCTIONS FOR USE OF FSH-P FOR SUPEROVULATION

FSH-P is follicle stimulating hormone (pituitary). An extract from the pituitary gland at the base of the brain.

Store the vials in the refrigerator before and after mixing. The left over solution must be frozen if it is to be used in the future.

FSH-P is used to stimulate the development of extra follicles in the ovaries of the donor cow before she comes into heat. The donor must then have a normal heat when the follicles are ready so they are released and may be fertilized. Prostaglandin (PG) is used to induce heat at the required time. An intravaginal device (PRID) is often used to control the cycling and this will be explained if it is used.

FSH does not last for long and must be injected twice daily for four days, into muscle or under the skin. Stroe in the fridge. Prostaglandin is then given to the donor on the morning (and evening) of the third day of FSH treatment. The donor should be on heat on the fifth day. Refer to the programme schedule.

Recipients will take longer to come into heat than the stimulated donor and thus are given PG a day before the donor, that is during the morning or early afternoon of the second day of donor injections.

Inject the 10 ml of diluent into the powder vial carefully, allowing the air pressure to escape into the syringe. Mix gently by rolling only. Remove the doses required using 2 ml syringes. Read the graduations from the end of the black ruber plunger nearest the needle. Each small mark is one tenth of a ml and there is a longer line at 0.5 ml, a number at 1 ml etc. There is no need to remove the small air bubble from the syringe as this is taken into account by the scale and it helps to have some air to push out the last drops from the needle when injecting the donor. If some is lost then there is usually some extra left as the whole 10 ml is not often used and a small extra dose can be given if more than a few drops were lost.

FSH is a prescription item and must be used strictly as directed in the embryo transfer programme schedule.

SUPEROVULATION HEAT DETAILS

For best responses the donors usually come into heat two days after the PG. Some may be 'on' the night before. If they are not on until late on the expected day or the next day then expect a small number of ovulations, even only one. Some donors on heat at the expected time also have only one or two ovulations. You may wish to reduce the amount of semen used or use an alternative if the donor is late coming on.

The semen used must be good quality to fertilize superovulated donors. Fair semen may fail to give a good fertilization rate and even increased doses will not give better results. Poor semen is not to be used.

The timing of the AI is also important. This relies on knowing when the donor was first standing whenridden and frequent heat checks may be needed to determine when this occurs.

AI WITH ONE STRAW

The best time to give one dose is at 18 to 20 hours after the donor first stands. Because this is not often accurately known and because some older semen is not perfect it is adequate to give the one dose at 16 to 18 hours after first on. If there is doubt as to when the donor was on tend towards 16 not 18 hours.

AI WITH TWO STRAWS

If the donor is in heat when expected then a superovulated response is expected. Donor first on early morning: because the second dose the next morning will be at 20 to 24 hours after the donor is first on (or longer) then the first AI should be left until as late as practical that day close to 12 hours after (10 to 14). Donor on between 9.00 am and 12.00 noon: AI as late as practical that evening but then it is important to give the second dose early the next morning before 8.00. Donor on after 2.00 pm: unless she can be AI'd after 10.00 pm that night it would be better to make the effort to AI before 7.00 am the next morning. Otherwise AI as late as possible that evening and again the next morning; the later after 2.00 pm the donor is first seen on then the early next morning dose is very important and if it is given at 18 to 20 hours accurately (no later) this one will suffice alone. Since late donors usually have less response then this is also reason for one dose.

NATURAL MATING

This is good as long as the bull is sound. Allow services to occur when first on and then the bull may be removed for 3 to 5 hours to ensure a further service when returned to run with the donor until removed afterwards.

THE FEED REQUIREMENTS OF DIFFERENT CLASSES OF LIVESTOCK IN TERMS OF METABOLIZABLE ENERGY AND CRUDE PROTEIN %

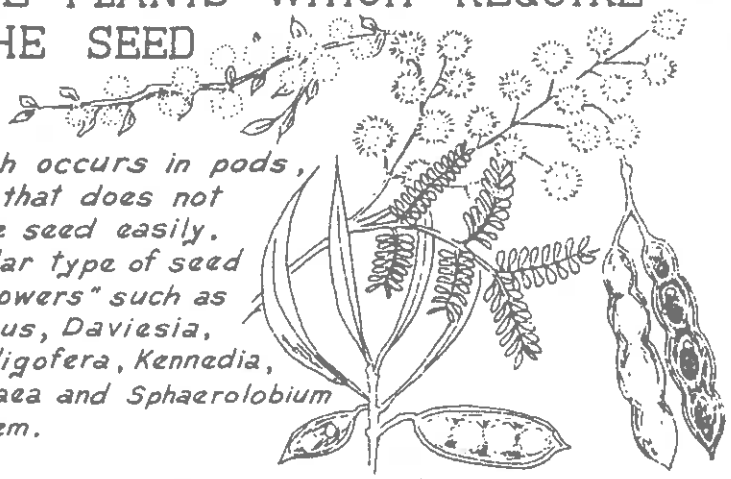
CLASS OF ANIMAL	M.E. MJ/DAY	C.P %
Wether (35-45 kg)	7	6
Dry Ewe	9.8	8
Ewe last 4 weeks of gestation	11.9	8.5
Ewe with lamb at foot	18.2	10
Ewe with twins at foot	23.1	10
Weaners 15-25kgs	10.5	10
Weaners 25-35kgs	12.6	10
Fattening wethers 40-50kgs	23.1	9
Rams	14	7
Mature cow 450 kgs	49	9
Lactating cow	73.5-98	10
Calves 150-200kg liveweight (L.W)	35	12
Calves 200-250kg L.W	42	12
Steers (Fattening) 250-350kg L.W	49	11
Steers (Fattening) 350-550kg L.W	73	10
Steers (Fattening) 550-650kg L.W	84	10
Pregnant Sow	20	15
Lactating Sow	60	16
Breeding Boars	25	15
Gilts	25	16
Growing Pigs 20kg L.W	9.4	16
Growing Pigs 40kg L.W	17.4	15
Growing Pigs 60kg L.W	23.5	14
Growing Pigs 80kg L.W	28	14
Broilers 0-6 weeks	13.4	23

Broilers 6-9 weeks	13.4	20
Replacement Pullets 0-8 weeks	12	21.5
Replacement Pullets 8-20 weeks	12.2	15
Layers	12.2	15

WATER REQUIREMENTS OF DIFFERENT CLASSES OF LIVESTOCK

CLASS OF LIVESTOCK	LITRES / DAY
Sheep	6.6
Horses	44
Beef Cattle	44
Dairy Cattle	66
Pigs	6.6

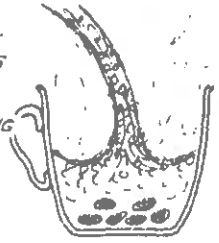
HOW TO GROW **Acacia** (WATTLES) AND OTHER NATIVE PLANTS WHICH REQUIRE TREATMENT OF THE SEED BEFORE SOWING



1. *Seed of Acacias, which occurs in pods, has a tough outer shell that does not allow water to enter the seed easily. Other plants with a similar type of seed include the many "pea-flowers" such as Cassia, Chorizema, Clianthus, Daviesia, Hardenbergia, Hovea, Indigofera, Kennedia, Oxylobium, Pavonia, Pultenaea and Sphaerolobium to name just some of them.*

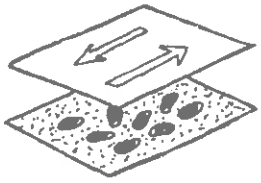
2. *For a seed to germinate, water must enter the seed. In the case of these hard-coated seeds, we must do something extra to get the seed to grow. For wattle and similar seed, we treat the seed with boiling water before sowing it.*

3. *Place the seed in a cup (not plastic) or some other heat-proof container and pour boiling water over it. Allow the seed to soak overnight and you should notice that some or all of the seed has swollen. Seed that has not swollen should be treated again.*



TO MAKE SURE NO ACCIDENTS HAPPEN, ASK AN ADULT TO POUR THE BOILING WATER ONTO THE SEEDS.

OR

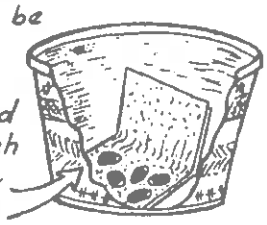


An alternative to the boiling water treatment is to gently rub the seed between two sheets of fine sandpaper. This reduces the thickness of the seed coat and allows water to penetrate.

4. *Swollen seed or seed which has been sandpapered is now ready for sowing. You can place the seed between sheets of moistened paper towel and then place them in a sealed container, such as an empty margarine container, or it can be sown directly into a suitable soil-mix. If you use the margarine container, you will be able to look at the seed now and again and only plant those seeds which have germinated.*



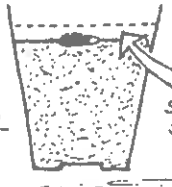
ONLY SOW SWOLLEN SEED



STORE IN A WARM, DARK PLACE UNTIL THE SEEDS HAVE GERMINATED

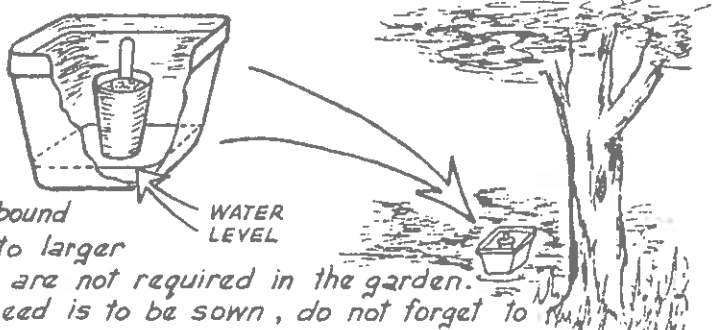
IF THE SEEDS HAVE GERMINATED, YOU WILL NOTICE A WHITE "SHOOT" COMING OUT OF THE SEED. THIS IS REALLY THE FIRST ROOT AND WILL SOON BE FOLLOWED BY LEAVES.

5. *The seed can be placed into a small pot containing a suitable soil-mix such as 1 part of peat moss and 4 parts of washed river sand. The seed should be just covered with the soil-mix. Make sure the soil-mix is moist before you place it in the pot.*



LIGHTLY COVER SEED WITH SOIL-MIX

6. *Place the pot in a partly shaded position and water by standing the pot in a partly filled container of water. Plants should never be allowed to become root bound and should be potted-on into larger pots when needed, if they are not required in the garden. If more than one sort of seed is to be sown, do not forget to label each type with its name and the date the seed was sown.*



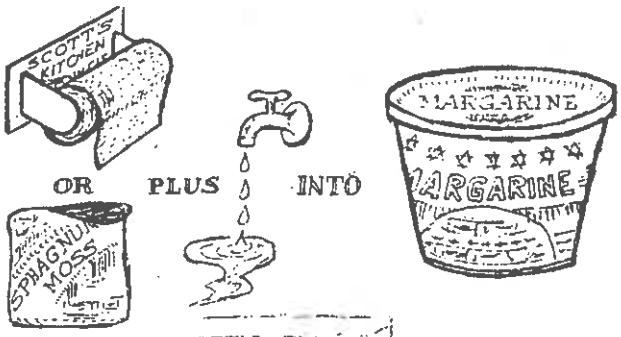
WATER LEVEL

HOW TO GROW

Banksia, Hakea

AND OTHER NATIVE PLANTS
WHICH HAVE LARGE SEED

1 *Moisten some paper towels or chopped sphagnum moss and place in a sealed container. An empty margarine container is suitable for this method of plant propagation.*

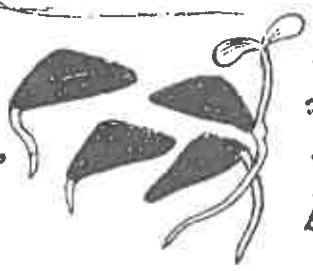


2 *Place the seed on the sphagnum moss or paper towels after first making sure that the moisture retaining material you have chosen is only damp, not wet.*



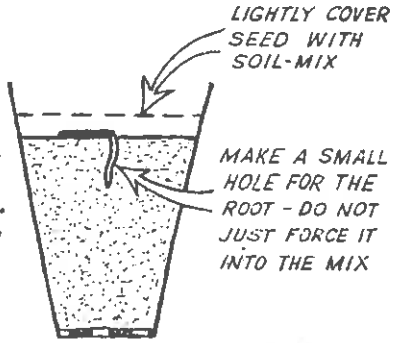
Seal the container and place it in a dark, warm place such as a cupboard.

3 *After about a week, the container should be checked to determine if germination has occurred, and then checked every few days thereafter.*



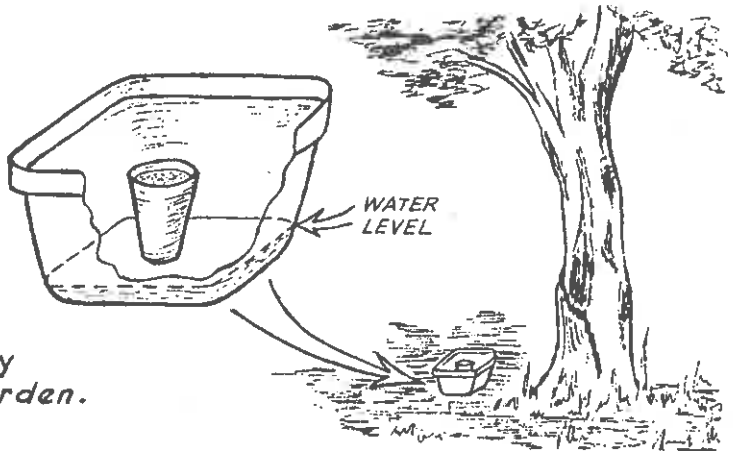
If the seed has germinated you will notice a white "shoot" coming out of the seed. This is actually the first root and will soon be followed by the leaves.

4 *As soon as the seed has germinated, it can be placed into a small pot containing a suitable soil-mix such as 1 part of peat moss and 4 parts of washed river sand. The seed should be just covered with soil-mix. Make sure the soil-mix is moist before you place it in the pot.*



5 *Place the pot in a partly shaded position and water by standing the pot in a partly filled container of water.*

Plants should never be allowed to become root bound and should be potted-on into larger pots when needed, if they are not required in the garden.



THIS METHOD OF PROPAGATION IS KNOWN AS PRE-GERMINATION

NATIVES AT SCHOOL - ANOTHER LOOK

Glen Callaghan's article in the September issue of Native Plants has prompted me to write a long-overdue report on what is happening with native plants in another school - Camden High School. I am a member of S.G.A.P., a teacher of Agriculture and have a strong belief that we must educate our children about native plants if we hope to encourage their widespread cultivation in the future. I count myself as being privileged to be in a position to do just that.

I had not grown or propagated a native plant until my wife and I purchased our first house at Baulkham Hills, in 1980. Although about twenty years old it had a very sparse backyard - three Camelias, one Privet, one Mandarin and a magnificent Eucalyptus elata! By the time we left at the beginning of 1984 we had a developing native garden. I had developed a passion for cultivation of native plants and had taught a Horticulture Course to Year Eleven students at Galston High School in which over 1,000 plants were propagated during one year (1983).

My move to Camden High School co-incided with a new syllabus for my subject area - Agriculture. This syllabus requires all junior Agriculture students to gain practical experience in plant propagation. Since native plants can be used to gain experience in nearly every method of plant propagation my colleagues and I decided to develop a unit of work for our Year 9 students in which we would teach the theory and practice of plant propagation using native plants wherever possible. We had an under-utilized glasshouse, a frame for a shadehouse and a few pots. These form part of our small school farm - about 0.5 hectares of land which is subject to flooding from the Nepean River. A major flood inundates the entire area, including the glasshouse. However, we manage to grow a variety of vegetables and fruits and keep fowls, ducks, turkeys, sheep, a goat and a Jersey calf. We acquired some new shadecloth, some poly pipe and micro-jets for watering and set about teaching our students the basics of plant propagation.

Initially we grew a range of plants from seeds, concentrating on Eucalyptus and Callistemon. By autumn 1985 we had around 500 trees growing in 1.5 litre sized nursery bags and ready for planting. All of these were sold to staff, their friends, students and parents. This early success lead us to increase our efforts. We began to expand the range of plants rown from seed - Banksias, Acacias, Waratahs, to name a few. The "Banksia B.B.Q." is one of my favourite lessons - kids are fascinated by the slow opening of the follicles and the consequent release of a seed perfectly adapted to be spread around by the winds that frequently accompany a bushfire. We also began to propagate plants from cuttings - Melaleucas, Callistemons, Grevilleas and others. The cutting material initially came from my own new native garden. Much of it still does, along with material from native gardens we have developed in the school grounds.

Our first garden area was developed in 1984 by removing a number of large Oleander bushes and replacing them with bird-attracting natives purchased at the local nursery (who provides us with a 20-25% discount on plants and landscaping supplies). We grew new plants by taking cuttings from these. This covers an area about 10m x 10 metres. We extended it in 1985 by removing more Oleanders and planting trees and shrubs propagated at the school farm. That area now covers some 30m x 10m and is quite well developed. Nectar feeding birds can sometimes be found in it. All of this was done during normal Agriculture lessons, with the help of many students and on a shoestring budget.

Meanwhile, our plant propagation enterprise had gone from strength to strength. We were selling many trees and shrubs to staff and students, but were finding it easier to propagate them than to find homes for them. In 1986 I became aware of a charity/ animal welfare group called Australians for Animals, who were seeking Koala fodder trees for planting around Lismore. This provided a perfect opportunity to incorporate a wider environmental perspective into our teaching. We propagated over 1,800 Eucalyptus tereticornis during 1986 and 1987. There were donated to Australians for Animals who distributed them to landholders around Lismore where populations of Koalas were under threat. We received a number of letters from these people expressing amazement at the source of their free trees and gratitude for our concern - these letters were extremely well received by our students.

Glen Callaghan mentioned the "Plant and Save" program in his article. It provided us with another "market" for our trees and a further link between school work and the environment beyond. "Plant and Save" is a project initiated by Mrs. Margaret Lyons from the Community Relations Unit of the N.S.W. Department of Education late in 1987. She advertised for schools to become involved and expressed particular interest in our tree growing enterprise and facilities. In 1988 we propagated some 1,500 Eucalyptus nicholii, pulverulenta and parvifolia. These are now growing in school grounds all over N.S.W. Leumeah High School and the Ryde College of T.A.F.E. also grew plants as part of this program. The K-Mart company provided valuable sponsorship. The official launch of it took place at Camden High School in October, 1988. The project is continuing in 1989 and we have a large number of seedlings almost ready to be potted up, together with some cuttings of Grevillea shiressii and Correa baeverlenii. We were featured on the S.B.S. program Education Today in July this year. A spin-off from this project was the discovery that we have a very endangered species of our own - Eucalyptus benthamii or Camden White Gum. We have acquired 10 trees from the Water Board (which are growing strongly and are very attractive) but have been unable to find a source of seed. Can anyone out there help?

Our planting program in the school grounds is continuing. Two more areas were landscaped and planted with natives during the last weeks of the 1988 school year. Old and neglected exotics were removed to make room for them. After this years big wet they are now beginning to grow strongly - with a few replacements added. In March this year we provided 200 Eucalypts as part of a local tree planting program along a barren road leading out of town. Some 25 of our students joined other community members in planting over 1,000 trees and shrubs in just 2½ hours.

Currently we are re-designing and re-planting the front entrance to the school. Old and neglected trees and shrubs, again all exotics, are being removed and new gardens put in their place. Natives will again dominate these areas. Students are involved in the planning, construction work and planting. Our P & C Association has given us valuable financial help in these more recent project as quite a lot of money is required to fence garden areas off and raise the soil level.

So there it is - native plants are being propagated and grown in a number of schools in N.S.W. I have spoken at several inservice afternoons organised by the Sydney Branch of the N.S.W. Association of Agriculture Teachers. My experience is that many of my colleagues are developing an interest in the propagation of native plants. Perhaps you, through your local P & C Association, can encourage and assist them. The N.S.W. Department of Education has recently released a policy called "The Greening of Schools" which encourages schools to develop school "environmental areas" and to initiate re-cycling projects. Why not try and find out what your local school is doing and lend a hand, where you can. Our native plants need all the help they can get.

ARTHUR KELLY,
Agriculture Teacher,
Camden High School.

Printed in Native Plants for NSW
Vol 24 No 4 December 1989

SOCIETY FOR GROWING AUSTRALIAN PLANTS.....N.S.W. REGION

PROPAGATE YOUR OWN NATIVE PLANTS

Many Australian native plants can be readily propagated by the home gardener; complicated equipment and 'green fingers' are not needed..

The principal methods of interest are: a) seeds, b) cuttings, c) division and d) grafting.

SEED

Seed is available from several commercial suppliers and Society members may obtain seed free from the co-operative seed bank.

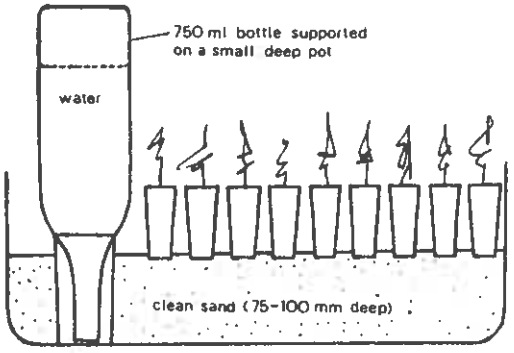
Not all seed germinates easily, however, and the beginner would be well advised to select from that which has proven to be reliable (e.g. wattle, bottlebrush, Eucalypt, Banksia, Hakea, Casuarina.....to name just a few).

Before sowing. In some cases seed has a natural dormancy which must be broken for successful germination. The most commonly encountered example is seed of plants such as Cassia, Acacia and all the 'pea' family in which the hard seed coat is impervious to water. This problem can be easily overcome by pouring boiling water over the seeds...those that swell after a few hours soaking are sown; those that don't are re-treated.

The growing medium. A good medium both for seed raising and for subsequent potting-on consists of 80-85% washed river sand and 15-20% peat moss. The medium should be reasonably moist before use.

Planting the seed. Seed may be sown into punnets, small pots or tubes and is normally covered to a depth of about double the seed diameter. Fine seed should be lightly sprinkled over the surface of the seed mix and need only be pressed down firmly. Large seed should be well spaced to facilitate later transplanting. Use of individual tubes is an advantage when only small quantities of plants are required as large seed can be sown one to a tube while fine seed can be thinned out as germination occurs to leave one seedling.

Care and attention. After sowing, the seed bed should be kept moist and sheltered from drying winds and from rain. Some sunlight is an advantage. With overhead watering a fine spray is necessary to avoid damage to small seedlings. A good method of watering for small quantities of seed is the use of a capillary bed as shown. With this arrangement seed and seedlings can be left unattended for 2 or 3 days (up to a week or more in cooler weather). The seed mix in the containers must be fairly moist before placing in the capillary bed otherwise the capillary action may not occur.



CAPILLARY BED

A cheap plastic tub will hold about 50 x 38 mm tubes The mouth of the bottle should be about 5 mm above the bottom of the tub

Pests and Diseases. 'Damping-off' causes rotting of the stems of seedlings at soil level, particularly in seed mixes that are over-wet. At the first sign of trouble the seedlings should be sprayed with a fungicide and extra attention given to moisture control. Snails and slugs may be controlled by the use of Baysol or a similar product. Any caterpillars that appear should be physically removed...use chemical sprays as an absolute last resort.

Transplanting. Seedlings growing in punnets or the like should be potted into tubes (or small pots) when they are large enough to handle. This is usually when the second pair of leaves appear. Individual seedlings are carefully removed from the seed bed using a 'dibber'...a piece of aluminium about

For information on S.G.A.P. contact
THE SECRETARY, 5 ELLESMERE RD. GYMEA BAY, 2227
'phone :-(02)5257484

100 mm. long by 10 mm. wide is a suitable dibber but anything similar will do. Each seedling should be placed in a partly filled tube and potting mix gently firmed around it. A small amount of slow release fertilizer in the potting mix is an advantage at this stage (e.g. 8 month Osmocote as per directions on the pack).

Growing-on. After transplanting, the seedlings should be placed in a protected position for a couple of weeks and gradually moved into a situation where full sun is available for at least part of the day. The seedlings must not be allowed to dry out and could, in fact, be placed in a capillary bed. After 2 - 3 months tubed seedlings will be ready to transplant into 125 - 150 mm. pots.

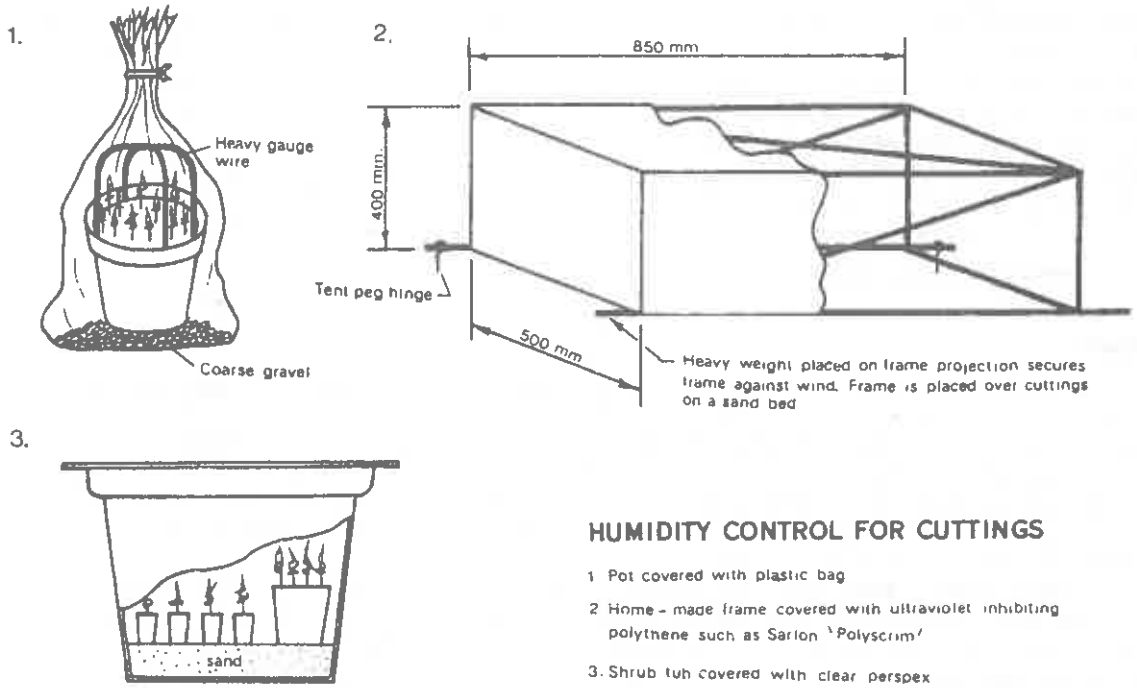
Planting out. Plants will be ready for the garden when good root development has occurred. This can be checked by carefully tapping the plant out of the pot. Plants should not be allowed to become pot-bound.

CUTTINGS

A cutting is a piece of the stem of a plant which, under suitable conditions, will initiate root growth. Propagation by cuttings has a number of advantages over seed propagation, the most important of which is the reproduction of plants of identical form and flower colour as the parent. This cannot be guaranteed with seed and, for this reason, named cultivars MUST NOT be propagated from seed.

Collection of material. Cuttings should be taken from firm current season's growth. Both hard, woody material and soft, 'floppy' growth should be avoided. Cuttings can be taken at any time of year but root formation is very slow in the colder months.

Equipment. The main requirements are a clean, sharp knife or blade and a cold frame to maintain a humid environment while the roots are developing. The 'frame' could consist simply of a plastic bag tied around a pot of cuttings. For larger quantities a small frame could be built.....the size shown will house a couple of hundred cuttings.



HUMIDITY CONTROL FOR CUTTINGS

1. Pot covered with plastic bag
2. Home - made frame covered with ultraviolet inhibiting polythene such as Sarlon 'Polyscrim'
3. Shrub tub covered with clear perspex

Containers. Cuttings can be placed either in individual small tubes or a number can be placed in a pot. A potting mix similar to that suggested above for seed is suitable.

Preparing the cuttings. Cuttings are generally about 75 mm. long. If the material is suitable two or three cuttings can be made from the same piece of stem. The lower end of the cutting should be cut directly below a leaf/stem junction (a node). The bottom half to two thirds of the leaves are stripped off if this can be done without tearing the bark; otherwise leaves are

carefully cut off. Large leafed species should have the area of the remaining leaves reduced by about a third. The lower 15 to 20 mm. of the cutting can be 'wounded' to encourage root formation over a larger area; this is done by removing a small sliver of bark with a sharp knife.



A PREPARED CUTTING

Hormone preparations. Root initiation can often be assisted by use of hormone preparations. These are available in a powder form and are applied to the base of the cutting. The 'medium' strength is recommended for most applications. Liquid preparations can sometimes be obtained.

Setting the cuttings. Cuttings should not be pushed into the potting mix. A hole should be prepared and the cutting placed so that it touches the bottom. The potting mix should then be firmed around it. After all cuttings have been 'set' they should be watered and placed in the propagating frame in a shaded position. The frame should be kept closed to maintain humidity and should also be kept as full as possible for the same reason. If insufficient cuttings are available empty areas can be taken up with open containers of water.

Care and attention. The aim is to keep the potting mix moist (not wet) and the foliage cool. In hot weather a light spray, sufficient only to wet the foliage, should be applied at least morning and evening and a more thorough hosing given as needed. The frequency of hosings depends on the circumstances but is unlikely to be more than twice a week in hot weather. The foliage spray should be minimized for cuttings with dense, hairy leaves (e.g. flannel flowers) as rotting may occur. If fungal problems develop, use of a fungicide spray may be of benefit.

Root formation. Many cuttings will 'strike' (i.e. form roots) in 4 - 8 weeks in warm weather. Roots may appear through the drainage holes in the pots or development may be checked by gently tapping out the soil mass.

Hardening. This is a most essential step and can be carried out using a similar (though smaller) frame to that used to strike the cuttings. The hardening frame, however, is propped open at night. After two weeks of this treatment struck cuttings will be sufficiently hardened to be moved to a shaded position for another two weeks. They can then be moved into the open. Cuttings in individual tubes are best hardened before potting on. In cases where a number of cuttings are in the one pot the soil mass should be gently broken up; struck cuttings are transplanted into individual small pots for hardening and those without roots can be re-set and placed back in the propagating frame.

Growing-on and planting out. As for seedlings.

DIVISION

Division is most often used with plants, such as Kangaroo Paws, which form grass-like clumps. The plant to be divided should be carefully dug up or removed from its pot and cut into smaller sections using a clean, sharp knife. At least one or two shoots should be left on each section. Dead leaves and dead roots should be removed. Spring and Autumn are the best seasons for division and the sections should be potted up and placed in a sheltered postion for a few weeks until new growth appears.

Other plants that can be propagated by division are those that sucker (i.e. form new shoots from the roots) such as some Lechenaultias and Dampieras and those that self-layer (i.e. form roots where stems touch the ground). In these cases the desired section of the plant is carefully severed and dug up and, after potting on, can be treated as outlined above.

GRAFTING

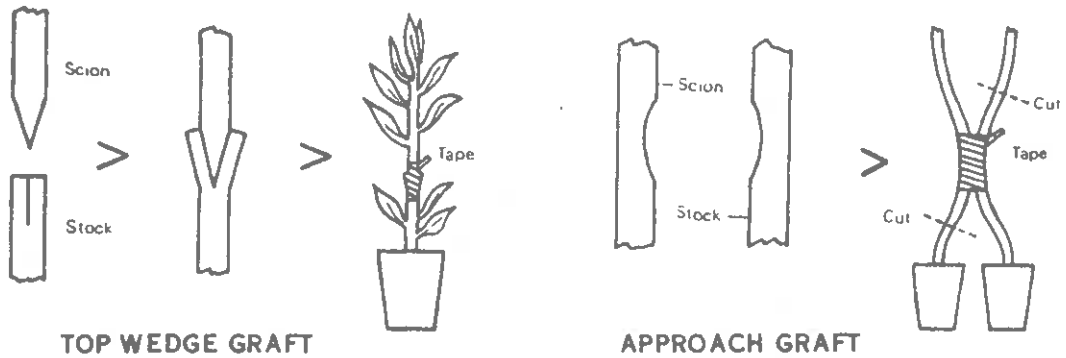
Grafting is not usually thought of as a method for the home gardener. However, the techniques involved are not difficult and are well within the scope of anyone who has mastered propagation by cuttings.

Grafting is normally used when propagating plants which are not hardy on their own roots. The graft consists of a top portion (the scion), which is the desired plant, joined to a hardy rootstock so that as much as possible of

the cambium layer of each is in contact.

There is a wide scope for experimentation with grafts of native plants. The main concern is that the scion and stock should be compatible.....this normally means that they be in the same genus or at least in the same botanical family.

A good confidence boosting graft to try initially is a mint bush, such as Prostanthera nivea, grafted onto the Coast Rosemary (Westringia fruticosa) as stock using the top wedge graft described below. Mint bushes, although of immense horticultural potential, are often short lived on their own roots. Other grafts that could be attempted include some of the Western Australian Banksias onto hardy eastern species such as Banksia serrata or robur. With all successfully grafted plants, any shoots that occur from below the join must be removed.



TOP WEDGE GRAFT APPROACH GRAFT

Top wedge graft. For best results the stock and scion should be of the same stem diameter (this facilitates the matching up of cambium layers). The stock would need to be propagated by seed or cutting some months prior to the graft being made (unless a cutting graft is used, as described below). The stock should be cut off about 50 mm. above the soil level. A few leaves should be left on the stock until the graft has been successful. A simple slit about 5-10 mm. long should then be made in the centre of the stem. The scion should be cut to a suitable length (say 75 mm.) and the bottom cut in the shape of a wedge of the same length as the slit. Leaves should be removed from the stock and scion in the area to be joined and handling of the freshly cut surfaces should be avoided. The scion should be inserted into the slit and the join tied firmly with grafting tape, wrapping from the bottom up. A coating of petroleum jelly should be applied to prevent water seeping into the grafted area. The grafted plant should be placed in a propagating frame until the scion shows new growth. At this stage the tape can be removed and the plant hardened.

Cutting graft. This is carried out in the same way except that the stock has no roots and the graft is treated as a cutting. In this way both grafting and propagation of the stock are carried out at the same time.

Approach graft. In this case both the stock and scion grow on their own roots until the graft has taken. A slice about 25-30 mm. long and $^{1}/_{3}$ of the stem in thickness is removed from each stem at the same height above soil level. The two stems should be joined and tied with tape (as shown) and the plant placed in a sheltered situation (perhaps a hardening frame) until the graft has taken. At this stage the stock and scion are cut as shown. This graft has been successfully used to graft the Western Australian Red Flowering Gum (Eucalyptus ficifolia) onto the hardier Red Bloodwood (Eucalyptus gummifera).

FURTHER READING

a) 'Australian Native Plants', Wrigley and Fagg (publisher, Collins).
b) 'Australian Native Plants', Blombery (publisher, Angus and Robertson).
c) 'Australian Plants' Journal, published by Society for Growing Australian Plants.
d) 'Growing Australian Native Plants', published annually by the National Botanic Gardens (particularly volumes 2 and 7).

and for those requiring a serious text:-

e) 'Plant Propagation - Principles and Practices', Hartmann and Kester (publisher, Prentice-Hall).

This wool unit is designed for senior secondary students. Its basic aim is to give an overview of the importance of wool to the Australian economy. Throughout, an economic perspective is provided together with reference to the historical and geographic nature of the industry.

Teachers of Australian studies in particular will find the materials most valuable as the clear contribution of the industry to work and the workforce in Australia is highlighted. Topics 1 to 7 especially provide an indepth coverage of the development of the industry and its importance to a specific Australian region – Deniliquin in southern New South Wales.

Courses having a strong economic emphasis will find Topics 8 to 18 of particular use. Linkages between wool production, structural adjustment of the Australian economy, technology, marketing, price support strategies and the balance of payments are all aspects which have been developed.

The unit is designed to be flexible. It is not necessary that teachers deal with all topics but selectively choose those areas relevant to their particular classes.

All topics are self-contained and draw their information and tasks from the material provided. There are, however, other activities which encourage students to undertake wider research using reference books, articles and library facilities.

Acknowledgements
The project has been commissioned by the Australian Wool Corporation, Melbourne, and has been produced by the Victorian Commercial Teachers' Association (VCTA) on behalf of the industry.

The writing team consisted of Anita Forsyth, Maree Prince and Robert Prince. Educational consultants, Colin Hobbs and Mike Rowland of the VCTA Curriculum Services Division were project managers. Thanks are extended to the many teachers who contributed their ideas to the development of the project.

Design
Concept design and finished art by Russell Bevers Design Pty Ltd.

Map Source
Deniliquin Topographical Map – Permission of Director, Central Mapping Authority, New South Wales.

Statistics
Please note that all statistics are as current as possible at time of printing. Some variation of figures may occur due to the seasonal nature of the industry and statistical methods used in their compilation.

Further Information
Please contact:
Communications Department
Australian Wool Corporation
GPO Box 4867
PARKVILLE VIC 3052

RESOURCE LIST

Teachers and students should be aware that to enhance their use of the kit they should have access to the resources listed.

Print Material

- "About Wool" Information Pamphlets
  1. Australian Wool Industry – Facts and Figures
  2. History of the Australian Wool Industry
  3. Guide to Wool Textiles
  4. Wool the Fibre
  5. Trademarks of Wool
  6. The Wool Reserve Price Scheme
  7. The Australian Sheep Flock
  8. Caring for Wool
  9. Properties of Wool
- Wool in Australia 1788-1988. A reference guide to events in the wool industry over 200 years.
- Working for Wool. Explains the role and functions of the Australian Wool Corporation.
- Annual Report 1988/89
- Video Catalogue – provides details on videos available for loan and lending conditions.

Audio Visual Materials

- "White Gold from Deniliquin" – 12 minute video outlining the development of the Peppin merino and the significance of the wool industry to the Riverina and Australia.
- "Australia's Wool Industry" Slide Set. This kit focuses on wool growing and exchange of ownership.

Posters

- "Australian Sheep Flock" – describes and illustrates the Australian sheep flock.*
- "Wool in Australia 1788-1988" – set of 4 posters illustrating major events in the story of wool since 1788.*
- "Wool Processing" – describes and illustrates the various steps in wool processing from fibre to fabric.*

* A4 print also available.

All the above resources are available from the Australian Wool Corporation.

General references

Hewat, Tim *Golden Fleeces* 1 and 2 (Bay Books, Sydney) 1986.

McCosker, Malcolm *Heritage Merino* (Owen Edwards publication) 1988.

Taylor, Peter *Springfield – the story of a Sheep Station* (Allen and Unwin) 1987.

Taylor, Peter *Pastoral Properties of Australia* (Allen and Unwin) 1984.

Statistical References

- Australian Bureau of Statistics (A.B.S.)
- Australian Bureau of Agricultural and Resource Economics (A.B.A.R.E.)
- Commonwealth Secretariat Wool Statistics

ustralian Wool Corporation

About Wool . . . INFORMATION ABOUT THE WOOL INDUSTRY FROM THE AUSTRALIAN WOOL CORPORATION, GPO BOX 4567, MELBOURNE 3001

RESERVE PRICE SCHEME

The Australian Wool Corporation has an important role in the raw wool market where it operates the Reserve Price Scheme (RPS) on behalf of woolgrowers.

Through this scheme growers declare the minimum acceptable value for their fibre. At the same time they seek to reduce unnecessary fluctuations in the market and thus to provide greater income stability for growers and a more predictable price for manufacturers.

Before the intoduction of the RPS – in two stages in 1970 and 1974 – the wool market operated free of any control. As such it was influenced not just by short and long term perceptions of demand by textile processors, but also by external factors such as currency fluctuations and the trading aspirations of operators within the market.

In 1970 the first element of the RPS was introduced, giving the Corporation's predecessor (The Australian Wool Commission) the capacity to enter the market on a flexible basis with the aim of arresting any slide in buyers confidence and providing a more solid footing on which values could be established. In 1974 this was bolstered by the addition of an immutable minimum value for each wool type (a "floor" price).

SETTING THE RESERVE PRICE

At the beginning of each season the Australian Wool Corporation, in consultation with the Wool Council of Australia, announces the Minimum Reserve Price levels for the coming selling season (financial year). An average or Market Indicator figure is set which represents an approximate average value across the entire wool clip. Prices for the many hundreds of specific wool types are then established around that average.

The following table details Market Indicator Floor Price levels for recent years:

AWC MINIMUM RESERVE PRICES BY CATEGORY

CATEGORY	1987 / 88 FLOOR	1988 / 89 FLOOR	1989 / 90 FLOOR
Market Indicator	645	870	870
19um	954	1570	1585
20um	867	1315	1315
21um	788	1069	1069
22um	732	965	965
23um	637	884	884
24um	558	778	778
25um	525	715	715
26um	503	648	652
27um	496	606	610
28um	483	579	583
30um	470	525	529
Mer. Cards	502	579	559
Xbd. Cards	435	446	446

THE RESERVE PRICE SCHEME IN ACTION

At all recognised public wool sales the Corporation values each individual sale lot at the Floor Price level. During the sale, any lot which fails to attract bids equal to or in excess of this valuation is purchased by the Corporation at the Floor Price valuation (regardless of the level of the losing bid).

When the market is trading above the Floor the Corporation may also assign a further, higher valuation and purchase at these levels. This "intervention" buying is used in particular circumstances, such as when fluctuating currency values or a sudden shift in demand patterns, create uncertainty in the market.

Wool purchased by the Corporation is held until demand improves and it is again required by wool textile manufacturers. The sale of these RPS stocks is mostly by private negotiation though some stocks are also used to augment auction catalogues.

Corporation purchases under the RPS have at times accounted for 30% or more of weekly auction offerings, and stocks have exceeded 1 million bales on a number of occasions.

In time of strong demand the reverse has been the case, with the Corporation a net seller of wool onto the market.

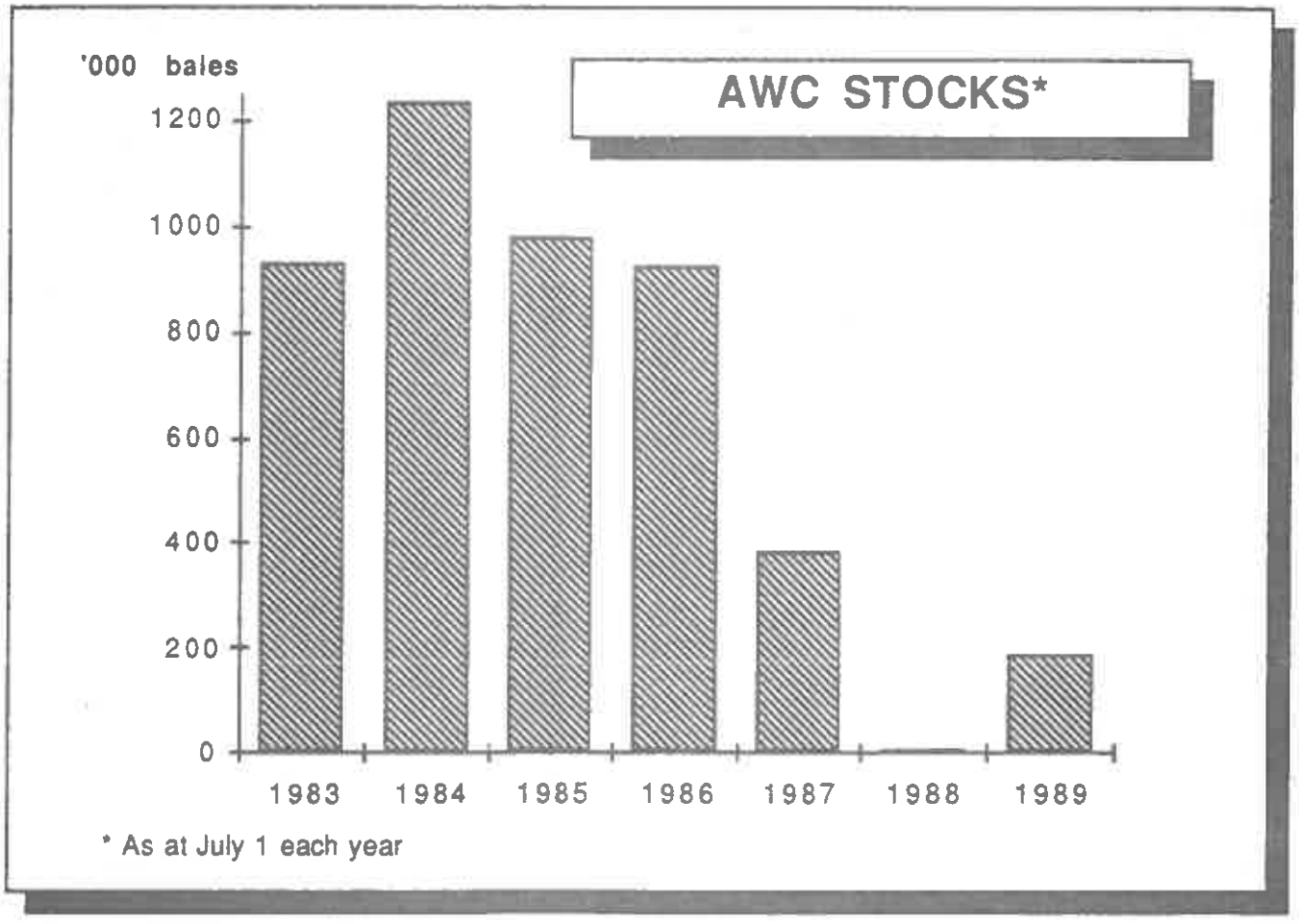
FINANCING THE RESERVE PRICE SCHEME:

With the introduction of the Floor Price in 1974, a Market Support Fund was established, to provide the essential financial backing for this scheme.

All woolgrowers contribute a portion of their gross wool income to the Fund each year (1989-90, 4.15%). The Fund is used to finance RPS purchases. Money not immediately required for RPS activity is invested with the interest returned to the Fund. Likewise, the proceeds from the sale of RPS stocks is returned to the Fund. Debited against the Fund are all costs associated with holding RPS stocks from the moment of purchase to their ultimate sale.

At the end of June 1989, the Market Support Fund had a balance of $1774.6 million. Growers contributed $230.3 million during the year, interest on investments totalled around $214 million.

The Wool Council of Australia's policy is that at the commencement of each wool selling season the Fund should have sufficient reserves to purchase up to one third of the clip in the coming year. If the balance exceeds this level, Council policy is to progressively return growers past Market Support Fund contributions. In 1989, the Council decided to return to growers their contributions from 1983/84 and 1984/85 which will total $219 million.





THE ROAD TO MARKET REFORM

While the present system of market protection was introduced in late 1970, attempts by growers to produce a more orderly market for their product, however, go back at least to 1885, when about 200 grower representatives met in Melbourne after a severe drop in the market and discussed a "Use More Wool" campaign and opening a mill in China. The market recovered the following year and the proposal lapsed.

The two world wars of the first half of this Century produced an impetus for orderly marketing that has flowed — laboriously and circuitously — through to the present system. In 1916, the British Government took the leading role in the Imperial Wool Purchasing Scheme under which it acquired all Empire wool, both for allied defence needs, particularly army uniforms, and to deny it to enemy powers. The purchase price was 15½ pence a pound (34.2 cents a kg.) and about two-thirds of the wool came from Australia. At the end of the war, the British Australian Wool Realisation Association (BAWRA) was formed to dispose of the surplus, in an orderly way without disrupting the market. Disposal took 17 years, resulting in a substantial profit to Australian growers.

WAR WAS SPUR

With both the approaching end of BAWRA's job and the fresh memory of the savage market slump of the depressed early 1930s, debate began on introducing a permanent market stabilisation scheme. It was a period when such schemes were a bitterly divisive issue throughout the rural community, for all products, and a ballot of growers rejected the proposal. Instead, the grower organisations and Commonwealth Government agreed on a much more modest proposal for an Australian Wool Board, charged with responsibility for promoting wool and wool research, as competition from synthetic fibres developed. The Board was established in 1936 and the International Wool Secretariat, representing growers from Australia, New Zealand and South Africa, the following year. Australian growers paid a levy of 6 pence a bale to finance it.

World War II broke out in 1939 and once again an inter-government acquisition scheme similar to that of 1916 was introduced. By 1945 the British Government held in stock more than 10 million bales. The Joint Organisation (UK — Dominion Wool Disposals Ltd.) sold the stocks over the first six years of peace, at a profit to Australian growers of $180 million. As disbandment approached, the participating governments — still with memories of the price slumps of the 1930s (when wool represented half of all Australian exports) — worked out an elaborate scheme for a reserve price system, broadly similar to that now applying in Australia. It was to be operated jointly by the three Commonwealth countries, however, in association with British processors. Encouragement from the industry was such that the new Menzies Government — which represented a move away from post-war controls favoured by the outgoing Labour administration — legislated for a provisional levy on growers of 7¼ per cent of gross revenue from wool to pay for it, plus ¼ per cent for promotion and research.

SUPPORT FROM PM

The Prime Minister, then Mr. Menzies, spoke in favour of the scheme, but a ballot of growers in August 1951 again produced a majority against the reserve price scheme — and a surprisingly large one, four to one. Much of the debate was about the financing rather than principle of it and it became enmeshed in other issues arising from the 1950 wool "boom", when prices soared on the outbreak of war in Korea. Among these issues was a special advance tax on growers' incomes. Once again, the industry preferred in the end a relatively modest scheme and the Australian Wool Bureau, with responsibility chiefly for promoting wool within Australia, was established in 1953.

New Zealand, however, introduced the reserve price scheme in 1951, using Joint Organisation profits. South Africa postponed it after defeat of the proposal by ballot in Australia but introduced it in 1958 when prices began falling again. With their years of experience, New Zealand and South Africa have substantially altered the scheme to fit their needs and in 1972 South Africa took the further step of acquisition of the whole clip by the South African Wool Board.

A steady rise in wool production in the 1950s bought severe falls in the price late in the decade and demands in Australia for a reserve price scheme and other improvements in wool marketing resumed. The Commonwealth Government appointed a Wool Marketing Committee of Enquiry, headed by Mr. Justice Philp of the Queensland Supreme Court, to sift the issues. The "Philp Report" of February 1962 opposed a reserve price scheme, as unlikely to produce sufficient benefits to justify the cost, but recommended formation of an Australian Wool Commission or Authority which would have responsibilities, other than the reserve price, similar

to those of the Australian Wool Corporation today. These included a centrally organised drive to improve clip preparation, an overview of research related to wool and the promotion work then done by the Wool Bureau. It also recommended formation of an Australian Wool Industry Conference to represent the three competing grower organisations and seek to produce a united grower voice.

The Wool Industry Act 1962 incorporated most of the recommendations. The Australian Wool Board was established in 1963 to become the new central body and the Australian Wool Industry Conference became its statutory grower advisory body.

However, drawn-out division in the industry over the degree of orderly marketing wanted was to continue for many years. The new Wool Board, after examining the market again, recommended a reserve price scheme and this proposal went — again unsuccessfully — to a referendum of growers in December 1965, after a long and bitter campaign.

Debate and study continued, resulting in the Price Averaging Plan (PAP) of 1970 to integrate small, inefficient sale lots of wool and dispose of them through pooling. Australian Wool Marketing Corporation Pty. Ltd., controlled by representatives of the growers, selling brokers and Wool Board, was established to operate the PAP, but its effective life was only three months from the first sale of PAP wool in August 1970. Late in 1969, while the company was being organised, wool prices began a steep decline and the Wool Board called together all sectors of the wool and associated industries, as well as Government representatives and economics advisors, to review the short and long-term needs of the industry.

One result of these talks was recommendation for a statutory organisation to administer marketing of the clip. The Government asked the eminent economist, Sir John Crawford, vice-Chancellor of the Australian National University, to review the proposal, after which legislation was passed to establish the Australian Wool Commission. It absorbed the PAP functions, had a number of responsibilities for improving marketing of the clip and, most importantly, was empowered to operate flexible reserve prices at auctions. The Commission began work in November 1970.

With depression in the market continuing, pressure continued from the industry for more refinements, both in wool marketing and organisation of industry bodies. After further investigation, the Government agreed to amalgamate the Wool Board and Wool Commission. This was accomplished by formation of the Australian Wool Corporation on January 1, 1973. The change was accomplished under a Labour Government elected a few months before, carrying out a decision of its Liberal-Country Party predecessor, so that the Corporation began work with political support from both sides.

LEVY INTRODUCED

Continuing with the brief of the earlier organisation to investigate and recommend on marketing improvement, the Corporation, in December 1973, proposed a radical marketing plan which involved the acquisition — for purposes of supply regulation — of Australian wool for export. In the meantime, however, events had taken over and after nearly 60 years the full reserve price scheme was finally introduced, almost an anti-climax.

The early 1970s saw more fluctuations in the wool market than for many years, climaxing in dramatic price declines resulting from a wool textile recession in 1970/71 and then the general recession induced by the oil price rises of 1973/74. The Corporation, taking a strong stand with its flexible reserve powers, found itself buying more than half the wool offered at auction in the depth of the 1974 recession. Its stocks were increasing rapidly. The Government, Corporation and grower bodies agreed that a fixed floor price, financed by a 5 per cent levy on growers' receipts from sale of wool, should be introduced as an interim measure, pending debate and a decision on the Corporation's more radical marketing proposals. Division among the growers and within the industry over some of these proposals was intense, but there was wide support for the floor scheme, which began operating in September 1974.

In the period since its introduction the reserve price scheme has proved to work well in practice, and has gained wide support from growers and processors alike. It has become established as part of the normal mechanism of wool marketing in Australia.

Australian Wool Corporation

About Wool . . .

INFORMATION ABOUT THE WOOL INDUSTRY FROM THE AUSTRALIAN WOOL CORPORATION, GPO BOX 1563, MELBOURNE 3001

N°1

AUSTRALIAN WOOL INDUSTRY STATISTICS

These statistics provide information on the main aspects of Australian sheep and wool production and on the activities of the Australian Wool Corporation.

1. SHEEP POPULATION (million)

N.S.W.	60.5
Western Australia	36.5
Victoria	29.8
South Australia	17.7
Queensland	15.2
Tasmania	5.0
N.T. and A.C.T.	0.2

TOTAL 164.9 million sheep (March 1989)

2. TYPES OF SHEEP

Approximately 80% of Australian sheep are pure Merino. Of the remaining sheep in the total flock, the vast majority are at least part Merino.

3. FLEECE WEIGHT

The average weight of fleece shorn from sheep increased from 3.87kg in 1965-66 to 4.65kg in 1988-89.

4. WOOL PRODUCTION

1988-89 Australia - 941.8 million kgs.

1988-89 Other Major Producing Countries

U.S.S.R.	484 (million kgs.)
New Zealand	335
Argentina	167
South Africa	98
Uruguay	87
U.K.	65
U.S.A.	41

In 1988-89, Australia produced approximately:

29% of the world's wool
41% of the world's apparel wool
70% of the traded apparel wool
52% of the world's merino wool
22% of the world's crossbred wool.

5. WOOL EXPORTS

97% of Australia's wool is exported.

Wool contributed $5.9 billion to export revenue in 1988-89 making it Australia's most valuable export.

Major Buyers of Australian Wool By Value

$A Million in 1988-89

Japan	1295.4	(21.8%)
USSR	866.4	(14.6%)
Italy	622.6	(10.5%)
France	567.1	(9.5%)
China	380.1	(6.4%)
Germany	309.8	(5.2%)
Korea Rep.	305.1	(5.1%)
USA	270.3	(4.5%)

Major Buyers of Australian Wool By Weight*

Million Kgs in 1988-89

Japan	156.9
U.S.S.R.	113.7
Italy	79.7
France	67.5
China	58.7
Germany	45.4
Korea	41.2
Taiwan	38.0
USA	37.4

* greasy equivalent weight, includes greasy, scoured, carbonised, tops, noils, waste.

6. AUSTRALIAN WOOL CORPORATION

Funding - Industry

In 1988-89, the total wool tax (8%) paid by woolgrowers on the sale of shorn wool produced and sold in Australia amounted to $434.5 million.

This was allocated as follows:

4.25%	to the Market Support Fund to finance the operations of the Reserve Price Scheme	$230.3 million
3.5%	to fund international and domestic wool promotion	$190.1 million

0.25% to fund wool research and development projects	$14.1 million

Funding - Government

In 1988-89, the Australian Government contributed:

To wool promotion overseas	$25 million
To research and development	$16.1 million

IWS Funding

In 1988-89, Australia's cost of contributions to the IWS annual budget was $169.8 million. This represented approx 70% of that budget.

Wool Tax Refunds

In 1988-89, $166.2 million of the contributions to the Market Support Fund for the seasons 1981/82 and 1982/83 was refunded to woolgrowers.

Australian Wool Corporation Wool Stocks

July 1, 1988, 9203 bales (or 1.5 million kgs)
June 30, 1989, 188,278 bales (or 31.8 million kgs)

	Promotion ($A million)	Research	Market Support	Total
From Industry (wool tax)	190.1 (i)	14.1	230.3	434.5
From Government	25 (ii)	16.1	–	41.1
Total	215.1	30.2	230.3	475.6

(i) For international / domestic promotion
(ii) For international promotion only

ORDER FORM

The Australian Wool Corporation invites you to order from the list of materials contained in this catalogue. Payment for charged items should accompany your order.

Number Required. (Max 30)

PRINT MATERIAL

- The Importance of Being Larry
- Larry's Learn to Knit Book
- Here's Wool
  - The Australian Wool Industry
  - Work on the Farm
  - Shearing
  - Selling the Wool
  - Sheep and Wool Terms
  - Wool, the Natural Fibre
- About Wool
  - Australian Wool Industry Statistics
  - History of the Australian Wool Industry
  - Guide to Wool Textiles
  - Wool the Fibre
  - Trademarks of Wool
  - The Wool Reserve Price Scheme
  - The Australian Sheep Flock
  - Caring for Wool
  - Properties of Wool
- Working for Wool
- Wool in Australia 1788-1988 (Cost: $7.00)
- Wool Industry Reading List
- Wool in Australia A4 leaflet
- Wool Processing A4 leaflet
- Australian Sheep Flock A4 leaflet
- Wool, Work and Wealth Resource Kit (Cost: $12.50)

AUDIO VISUAL MATERIAL

- The Importance of Being Larry (Cost: $15.95)
- White Gold from Deniliquin (Cost: $15.95)
- Australia's Wool Industry Slide Set (Cost: $10.00)
- Wrapped in Wool Slide Set (Cost: $10.00)

POSTERS

(One per School)

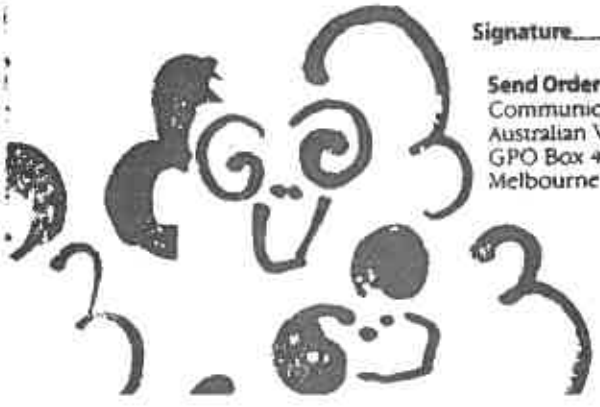
- Australian Sheep Flock
- Wool in Australia 1788-1988
- Wool Processing
- Collinsville Ram
- Australia's Wool Industry

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Send Order to:
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