1988 HSC
+ Answers.

BULLETIN

OF THE NSW ASSOCIATION
OF AGRICULTURE TEACHERS

B.A.A.T.

Volume 1 1989

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Volume 1 1989

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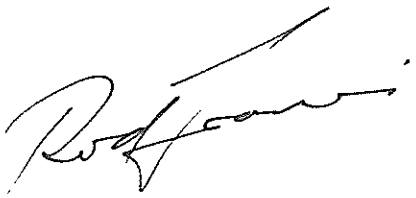
President's Message

I write this fresh and renewed by a most enjoyable Biannual conference in January. It was pleasing to see so many new and old faces, to discuss formally and informally with colleagues issues and ideas and to brush up on some agricultural skills and knowledge.

In its wisdom, the General Meeting of the Agricultural Teachers Association, held at the conference, moved the executive to Wagga. With myself and an enthusiastic group of agriculture teachers in this region, we hope we can keep the association growing and help to increase the professionalism of all agriculture teachers.

The conference made a major decision on the structure of the association. With the growing numbers in the association and the activities now occurring in agriculture it was felt that it was becoming difficult to expect the executive to do everything. As a result, the Sydney branch with its access to Joint Council and its facilities, would be responsible for publishing BAAT. This would leave the executive free to carry out its tasks of membership organisation, responding to the political battles, developing the profile of agricultural education in NSW and the organisation of the 1991 Conference at Murrumbidgee Agricultural College.

Ninteen eighty nine has its problems with education in NSW and this political climate can deflect us from providing the best agricultural and personal education to the children in our schools. In 1989 then let us fight on with the education battle as it affects our work and the students in schools but also concentrate on the growth and improvement of agricultural education. Do not let the "bastards get us down" - do the appropriate thing to their "lavatories" and get on with the job of providing, through the medium of agriculture, an environment for the development of our students and in them a feeling for agriculture as something useful and worthwhile in their lives.



Rod Francis

EDITORS MESSAGE

Firstly a very sincere thanks to Ian Foreman and his supporters for the extremely useful and informative editions of B.A.A.T. over the past few years - they are going to be hard acts to follow !

Somehow, Peter Crick and I came away from the conference at Tocal with the job of editorship of B.A.A.T. for the Sydney Sub - Branch ! Our proximity to the printing and distribution facilities of Joint Council at Rozelle and the resolve of the Sydney Sub - Branch committee to assist should make the job easier, however, we are still going to require the support of all our members.

Please send us your ideas, suggestions etc. we will be only too happy to share them with all your Agriculture teacher colleagues.

Notice too that fees are now to be paid on an annual basis ($20) not biannually ($ 40) as in the past. This is to facilitate updates of membership records and distribution of B.A.A.T. Encourage your Science/Ag teacher friends and colleagues to join and send your membership fees NOW to NSW AAT - PO Box 187 Rozelle 2039

Jenni Wilkins
Muirfield High

THE NEW EXECUTIVE OF THE NSW AAT

elected at Jan '89 Conference

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on Thursday July 6 and Friday July 7, 1989

commencing 9.30 am.

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An officer from the Soil Conservation Service will conduct a field trip to see the problems of soil erosion and soil acidification in the Bathurst region and the steps taken to remedy these problems.

* C 2. Reproduction, Breeding and Productivity in Animal Production Systems.

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* F 2. Trees on Farms.

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Enjoy meeting students from other schools in a relaxed atmosphere.

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Students are expected to make their own transport arrangements to and from Newhaven Park and to the farms being studied.

Estimated cost for meals, accommodation and field trips $35.00.

Teachers are welcome to attend. If you would like to contribute, please let the organisers know.

If you or your students are interested in this study tour, please contact one of the following and tell us:-

Your name, School, Address, Number of Students.

We will send you details and application forms.

Carolyn Nyman

Northholm Grammar School, 79 Cobah Rd, Arcadia 2159

Phone (02) 656 1417 (school) or (02) 86 4716 (home)

Sally Bannerman

Pennant Hills High School, Laurence St, Pennant Hills 2120

AGRICULTURE S.I.G. REPORT.

1988 was a relatively quiet year for the Agriculture Special Interest Group. A comprehensive survey was conducted at the beginning of the year into the working conditions of teachers. This brought many interesting factors about the amount of work and the variety of tasks teachers of Agriculture are expected to perform. While it was hoped that these findings could be used to build a case for improvements in working conditions, a change of government in March 1988 put paid to those plans. The resources of the Teachers' Federation were stretched to the limit attempting to maintain the status quo, and most campaigns aimed at gaining improvements were put on the back burner.

While the situation regarding the planned changes by the Government has not altered, the new school year has meant that Agriculture teachers have to give consideration to how they will be effected and what they can do. The increasing reluctance of staffs to cover teachers on excursions, will have serious implications for teachers trying to run Agriculture excursions for seniors and juniors. Federation is attempting to negotiate the coverage of school activities such as excursions , but what fruit this bears in the current climate is doubtful. While extras are an issue, it is important that Agriculture teachers support school staffs to win a better deal on extras.

It is clear many people still do not get period allowances to administer and program agriculture. The staffing document recognises this as a legitimate area of the school that is eligible to release time, however competing interests within the school often mean

Agriculture misses out. Generally if you persist and argue your reasons for gaining a period allowance in a logical fashion, you should achieve something.

Federation is planning a case before the Industrial Commission to gain a "class sizes award" for N.S.W. Government teachers. One of the parameters for this will be practical class sizes, and it is important that Agriculture teachers have an input. Give some thought to be involved as witness before the Commission as Federation will be calling for people with interest in these areas to be involved.

Government schools will be getting a newsletter and S.I.G. membership in the near future, which will be addressed to the Agriculture Teacher. If you are financial you will be welcome to join the S.I.G. as corresponding or active member. Please fill out the short survey to update the information gained last year.

Seen at the Biennial Conference, Tocal, January 1989.

a good VIDEO on the Poultry Industry

available from

The Australian Poultry Industries Association

100 Miller Street

North Sydney ph; 929 4077 or 929 3224

AGRICULTURE TEACHING PAST AND PRESENT - N.R. THOMAS

Biennial Agriculture Teachers Association Conference 1989

When first approached to speak on this subject my thoughts were mixed. In my fifty years involvement with school Agriculture I had seen it promoted and abused with monotonous regularity. At all times I had felt that the subject was one of true educational value. It could be adapted to all levels of students and be of value to them no matter what occupation they followed in later life.

The importance of Agriculture can easily be seen by simply looking at the flow-on effect. Begin with the producer -note the industries dependent upon servicing the needs of the producer-then follow the industries processing the products. Many industries are serving the so-called service industries. Take away the primary producer and in countries like Australia the economy as a whole suffers badly.

Unfortunately the diverse nature of Agriculture, the competition between products eg. butter and margarine, and the large numbers of individual producers tend to mitigate against uniform policies. Our politicians can always rationalise their decisions. This is especially so with Agriculture Education and a parallel between Agriculture as a school subject and the situation of the Agriculture industry can be easily found.

Throughout time the Agriculture teacher has been expected to work as an individual but with constraints over which they have no personal control.

Let us look at the syllabi. I can remember it taught as Agricultural Botany, Agriculture 1 and Agriculture 2 plus associated Sheep and Wool courses. John Spencer (1) has noted that the subject was first in the schools as a primary school course. It has proved to be of such value that even an Agriculture High School was formed and it became popular in Central and District Rural schools. Since then High Schools have proliferated, many of which offer Agriculture, and three more Ag. high schools have been established.

The syllabus content and standard has been greatly influenced by our tertiary institutions. Changes have occurred in the degree of prescription, approach, jargon and standards. The onerous work of examining candidates has seen many changes. Remarkably, although our tertiary institutions have such control over what is to be taught and how it is examined, there appears to be a reluctance to promote the status of the subject within the schools by allowing any credit to the Agriculture students who have successfully completed HSC courses. In many tertiary Agriculture faculties the study of Agriculture appears to be avoided in the first year. It speaks well for the Agriculture teachers that tertiary students' enthusiasm can still be maintained throughout the first year. If we read the article by Prof. Derek Tribe - Agriculture Under Threat (2) and the reports from the National Conference in W.A. (3) there is a possibility for increased interest in school Agriculture by the tertiary institution.

Any beneficial effects will possibly be greatly influenced by Educational Policies set at Head Office. In my memory there are times when H.O. policies were based on statements by people not in touch with Agriculture. Progress has been most apparent when strong personalities with a great deal of resilience, a knowledge of the state of affairs across the state, and a dedication to Agriculture teaching, have been able to represent the teachers and students. Names like Mullavey, Robinson and Rowland come immediately to mind. During their periods we had Regional Ag. consultants / advisors, Head Office consultant and Ag. Teacher inspections across the state by inspectors competent in Ag. teaching. Teacher placement and transfer within Ag. Sc. also had their recommendations. These things tended to lift teacher morale and effectiveness.

That we need such people is evident by the present situation. Teaching facilities within the schools reflect the degree of assistance to the Ag. teacher - look at the position of laboratories for schools - based on Science classes without allowance for Agriculture.

Promotion criteria still need reassessing. The positions of Ag. Head Teachers have increased but candidates for promotion still have to fulfill Science requirements and be placed on the Science List. It has been suggested by a few Ag. teachers that Science has a vested interest in retarding the expansion of Agriculture because the Science class periods may be below the magical number for a distinct faculty. Personally I feel that it is unfair to impose Agriculture onto a Sc. Head Teacher. Perhaps a re-introduction of something on the lines of Senior Assistant status for schools with insufficient Ag. student numbers for a separate faculty would help solve the problem.

Throughout my experience I have noted that Ag. teachers in conjoined faculties have always had to prepare their own programs, set and mark the exams, be responsible for full classes within the classroom as well as on the school farm, do their own accounting as well as being on call 24 hours per day, 7 days per week, 52 weeks per year. The help from the Farm Assistant is acknowledged but supervision still has to be maintained. Recently there has been some respite in some schools with a period allowance. It is still nowhere near being a fair allocation.

For some of the improvements credit must go to the Special Interest Group working within the Teachers' Federation. Some years ago the Minister for Education informed me that even Federation was not interested in us - we were comparatively few and therefore lacked political clout. That " fewness" could possibly be used to advantage due to ease of reaching concensus, communication and action. Other minority groups under good leadership have had successful impact.

The Ag. Teachers Association has given variable leadership. At times it has vertually been defunct but because of its potential it should be strongly promoted. Care in election of officers is essential. The Ag. Teachers' Association places an immense load on the officer bearers. The Biennial Inservice course, the dissemination of material in the bulletin, representation of opinions and policies is so invaluable that every Ag. teacher should join and assist. In the periods where the association lapsed or weakened, the classroom teacher found increasing difficulties. The formation of the National Association of Ag. Teachers in recent years is giving us an understanding of the variable situations within each state. There are common problems and these need assistance at the Federal level.

Teacher training has varied over time. It has an immense bearing on the future of the subject in schools. Student attitudes are influenced by all teachers and the supposed status of a subject is easily transmitted. A competent and interested Ag. teacher has the esteem and respect of other teachers, students and community.

To this end a lot depends upon the attitudes of the teacher trainers. Those who have been fortunate enough to see the likes of Prof. John Lovett and the late Alan Sutherland in action can appreciate how meaningful lectures can be.

Good Ag. teachers develop a raport with the community. They do this by involving the parents and local citizens in school Agriculture. Besides helping to overcome school problems this stratagem also gives the Ag. teacher an incentive to improve. It allows feedback to the teacher and promotes a meaningful understanding by the parents.

To summarize this diatribe may I reiterate some of the main points gleaned from teaching Agriculture.

1. The individual teacher can make or break the subject.

2. Teachers need to be willing to continue to learn.

3. Problems continue to exist but these can be lessened by having active and forceful representation.

4. Teacher training is of the utmost importance.

5. Communities respond to the subject if it can be shown to be of value- not necessarily vocational- but of overall educational value.

If Agriculture is to continue as a viable subject within the school we must all put aside petty and / or professional jealousies, acknowledge assistance and do our best.

Footnote

1. Dr., J.D.Spender. Agricultural Education in NSW- Function, Clientele, Development and Parodoxes. A paper delivered at U.N.E. Nov. 1988.

2. Prof. Derek tribe. Agriculture Under Threat. Ag. Sc. Journal Vol 1. No6 1988

3. BAAI Vol. 2 1988

N. R. THOMAS.

SAMPLE ANSWERS

15

J.S.
+
A.R.

(TOP answer)

Candidate's Number.....

Centre Number.....

PREPARED BY

THE NEW SOUTH WALES DEPARTMENT OF EDUCATION

FOR THE

BOARD OF SECONDARY EDUCATION

1988 HIGHER SCHOOL CERTIFICATE EXAMINATION

AGRICULTURE

2/3 UNIT

SECTION I

Time allowed for all three sections- Three hours
(Includes reading time)

DIRECTIONS TO CANDIDATES:

- Write your Candidate's Number and Centre Number at the top right-hand corner of this page.
- Attempt **ALL** questions in **Section I.** (Maximum of 25 marks).
- Questions MUST be answered in the spaces provided in this question booklet.
- Hand-held, battery-operated, non-programmable and silent calculators may be used.

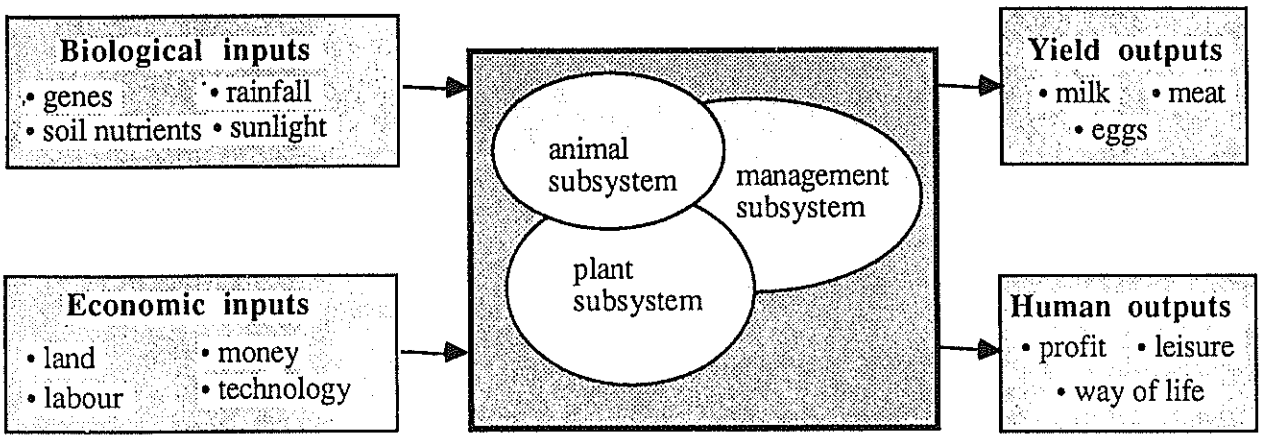
SECTION 1

Attempt ALL questions.
Recommended time - 40 minutes

QUESTION 1.

This question refers to a farm which you have studied. Examine the following general model of any farming system and the examples of inputs and outputs which are provided.

Figure 1. Farm model



Examiner's use only

For your farm, name:

an animal subsystem Vealer sub-system

a plant subsystem Pasture sub-system.

(a) In the above model, the plant and animal systems overlap. Describe TWO ways in which this interaction occurs on your farm.

Cows graze pastures to gain nutrition for maintenance and production of milk. Urine and faeces from cows adds nutrients to soil for use by plants for growth. + development

Examiner's use only

(b) In the above model, the management subsystem overlaps with both the plant and animal subsystems.

(i) Outline an important management decision the farmer has made which has resulted in a significant change to EITHER the plant OR the animal subsystem.

Addition of higher level of fertilizer to improve pasture growth.

(ii) Explain the short-term effect of this decision on the productivity of the farm system.

Productivity increased - increased pasture quality and quantity resulted in increased milk production.

(iii) Describe a potential long-term effect of this decision on the productivity of the farm system.

Productivity decreased due to increased soil acidity resulting in decreased pasture growth + milk production

(c) Explain how you would proceed to calculate the economic efficiency of a farm.

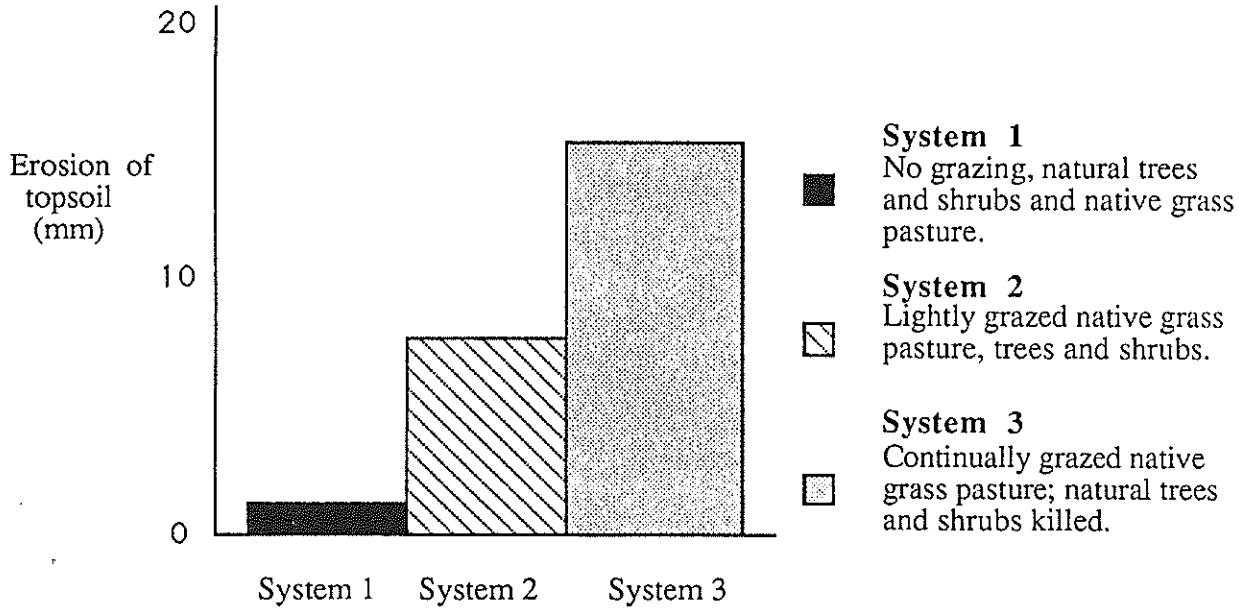
Calculate Gross Margin → income from outputs minus cost of inputs (variable). Comparing this to other similar farms in the area indicates economic efficiency. Partial budgets + marginal analysis could also be used.

(d) Explain ONE example where some "off farm" information has affected management decisions or strategies on your farm.

Information from the Department of Agriculture on a new rye-grass variety resulted in farmer using this variety in place of older variety

QUESTION 2.

Figure 2. Effect of management system on soil erosion



Examiner's use only

(a) From the information in figure 2:

(i) compare the effects of system 1 and system 3 on soil erosion;

System 3 had a much greater effect on soil erosion than did System 1

(ii) explain why system 2 and system 3 have a different effect on soil erosion.

The trees and shrubs and greater grass cover in System 2 would be effective in reducing wind erosion & slowing down water flow + reducing raindrop impact. System 3 is more exposed to these forces.

(b) Name ONE other problem that can occur in the resource system as a result of agricultural practices.

Salinity.

Examiner's use only

(c) One goal of agricultural systems is profit maximisation; another goal is long-term productivity. Describe how a farmer tries to balance these two goals.

The farmer does some "research" and decides on a plan with the flexibility to change if needed. Outcomes should be monitored. Strategies could include direct drilling to reduce soil degradation.

(d) For a farm which you have studied:

(i) state TWO constraints affecting production which have to be managed;

Disease incidence

Small gene pool

(ii) outline how the farmer attempts to manage each of these.

Treat cows suffering mastitis with penicillin; cull chronic sufferers.

Use A.I. programs with semen from progeny tested sires to reduce inbreeding.

(e) The following questions refer to an experiment which you have carried out during your course. Read the questions carefully before selecting an experiment on which to base your answers.

(i) Outline the main purpose of your experiment.

Growth rate of radish in response to differing N fertilizer rates.

(ii) List the treatments which were used in your experiment.

CONTROL, NITRAM at 100 kg/ha. and 200 kg/ha.

Examiner's use only

(iii) Describe the experimental design which was used. Illustrate your answer with models or diagrams if you wish.

KEY

C = CONTROL

N_1 = 100 Kg/Ha NITRAM

N_2 = 200 Kg/Ha NITRAM

N_2	N_1	C
C	N_1	C
N_1	C	N_2
N_2	N_2	N_1
N_1	C	N_2

* all seeds sown on same day and watered the same. same variety of radish in all plots

* whole plant dry matter weights, from a week six harvest, were recorded

The attempts at standardization (same water etc) tried to keep everything the same except for the variables the experiment was designed to test for.

Randomization eliminated bias so that each treatment had an equal chance of exposure to the good or bad factors inherent in the site

Replication enabled an assessment of variation within, and between, treatments to be made.

Examiner's use only

(iv) Explain how the design of your experiment allowed for the assessment of variation in your results. If the experiment didn't allow for variation, describe how the design could have been improved to allow for this.

My experiment allowed for assessment of variation because there was replication which allowed for calculation of error. The randomization deleted bias and permitted variation within the site to be assessed.



Sample Answers for

B.A.A.T.

22

Candidate's Number.....

Centre Number.....

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1988 HIGHER SCHOOL CERTIFICATE EXAMINATION

AGRICULTURE

2/3 UNIT

SECTIONS II and III

Time allowed for all three sections- Three hours
(Includes reading time)

DIRECTIONS TO CANDIDATES:

- Write your Candidate's Number and Centre Number at the top right-hand corner of this page.
- Attempt **THREE** questions only from **Section II.** (Maximum of 45 marks).
- Section II MUST be answered in the spaces provided in this question booklet.
- Attempt **TWO** questions only from **Section III.** (Maximum of 30 marks).
- Each question attempted in Section III is to be answered in a separate Writing Booklet. If required additional Writing Booklets may be obtained from the Examination Supervisor upon request.
- Hand-held, battery-operated, non-programmable and silent calculators may be used.
- Place a tick in the boxes to indicate the questions you have attempted in Section II.

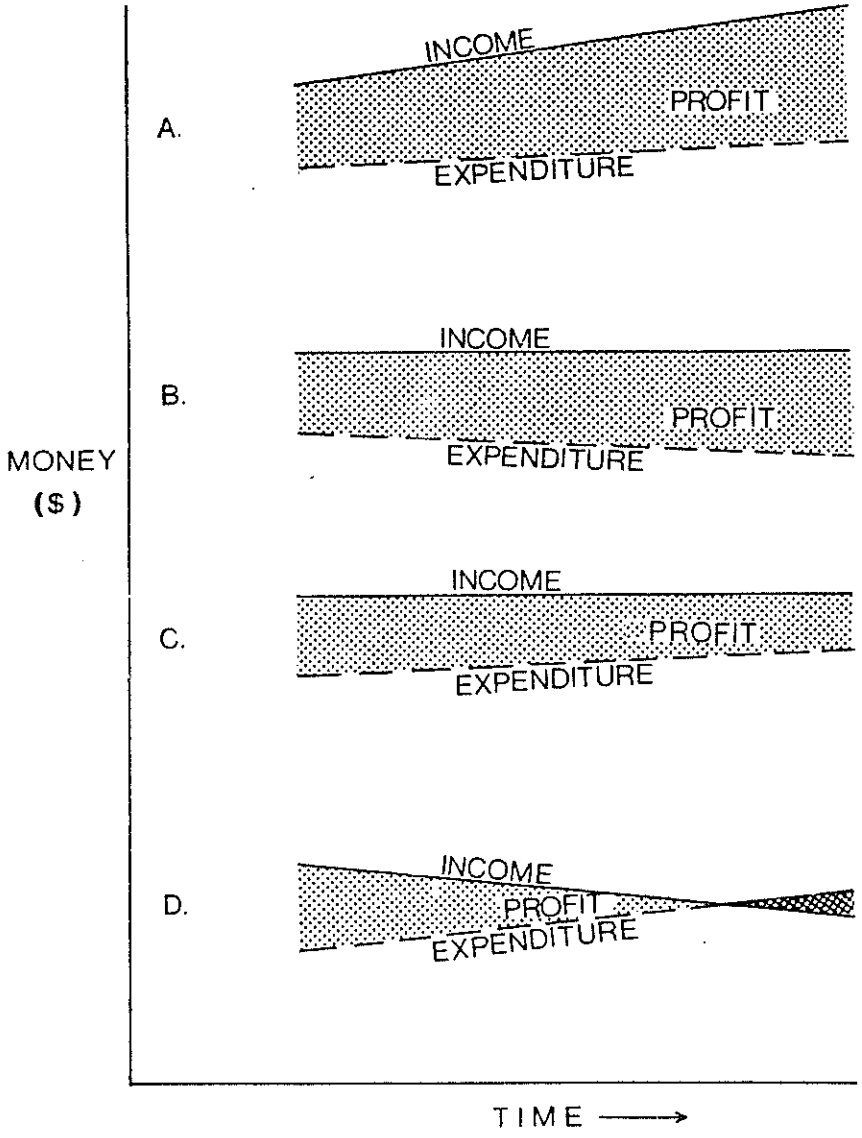
Question	1	2	3	4	5	6

SECTION II

Attempt THREE questions only from Section II
Recommended time - 80 minutes

QUESTION 1.

Figure 3. Trends in income and expenditure on farms



(a) From figure 3, write down ONE alternative (A, B, C or D) in which:

(i) profit is increasing A or B

(ii) profit is decreasing C or D

Examiner's use only

2

Examiner's use only

(b) For D in figure 3, describe how profit changes over the time shown.

profit decreases as a result of increased expenditure until it becomes a loss

2

(c) Explain ONE way in which a production system could be managed to produce the income and expenditure trends in:

(i) A in figure 3;

introducing a new variety which is higher yielding. This way expenditure may rise slightly however income increases at a greater rate

4

(ii) B in figure 3.

by reducing costs it is possible to maintain some level of income eg. reduced rate of fertiliser application, or ceiling once a year instead of twice, leading to a greater profit margin.

4

(d) (i) Explain some possible harmful effects of a farmer maintaining the situation represented in B in figure 3, over a long period of time.

decreasing expenditure may lead to; breakdown of machinery, disease outbreak, depletion of soil nutrients, soil erosion.

4

(ii) Identify an alternative strategy which might avoid one of the problems you have identified in (i) above.

Crop rotation to avoid depletion of soil nutrients

2

(e) (i) State ONE option a farmer might consider when faced with the situation represented in D in figure 3.

selling out - diversification - refinancing

1

Examiner's use only

(ii) Describe what information would be required by a farmer to enable a decision to be made about this option.

costs of new machinery
gross margins; market availability, competition
suitability of new product

3

(f) (i) For the major production system on a farm with which you are familiar, describe the income and expenditure trends.

Name of production system any system

0

Description of trends long term trends in income and expenditure
eg income received has increased over time
expenditure has increased at a slower rate.

2

(ii) Give two reasons for the trends described in (i) above.

Any specific features related to trends named above. eg. market demands

4

(iii) Explain ONE management implication for the farmer as a result of the trends described in (i) above.

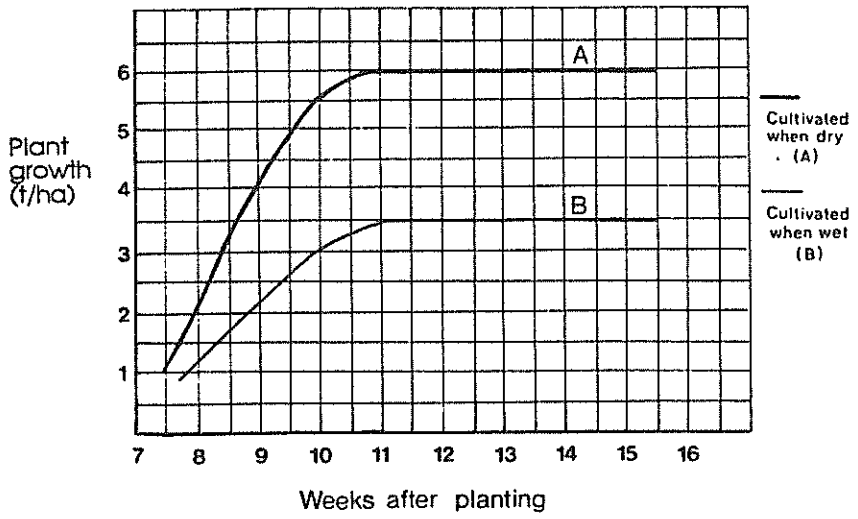
specific strategy related to (i) above

2

QUESTION 2.

(a) The moisture content in a clay soil during cultivation may affect the later growth of a crop. This is shown in figure 4.

Figure 4. Soil condition and plant growth



Examiner's use only

(i) Complete the following table for curve A in figure 4 above.

Table 1. Soil condition and plant growth

Weeks	Plant growth (t/ha)
8	2·0
9	4·0
10	5·5
11	6·0
12	6·0
13	6·0
14	6·0

2

(ii) During which week does plant growth begin to slow down in curve A?

WEEK 10

1

(iii) Explain ONE reason why plant growth slows down at this time.

REACHING MATURITY AND CHANGING FROM VEGETATIVE PHASE TO REPRODUCTIVE PHASE

2

Examiner's use only

(iv) Using the information from figure 4 above, what advice would you give a farmer about cultivating this soil type?

CULTIVATE WHEN DRY TO GAIN MAXIMUM GROWTH RATE OF PLANT

2

(v) Explain how the interaction between moisture content and cultivation could affect the soil in a way which reduces plant growth.

SOIL STRUCTURE EASILY DESTROYED WHEN SOIL IS CULTIVATED TOO WET. THIS RESULTS IN POOR INFILTRATION OF MOISTURE AND POOR AERATION WHICH REDUCES PLANT GROWTH

4

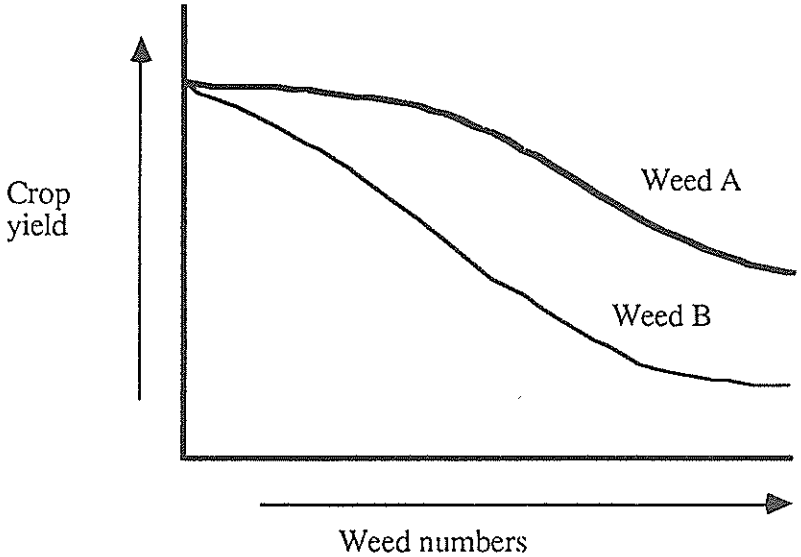
(vi) List TWO management techniques that can be used to overcome the problem of reduced plant growth caused by cultivation of the soil when wet.

CONDITION SOIL - GYPSUM, LIME, AERATE DEEP RIP, DRAIN.

2

(b) The following graph shows the effects of two different weeds on the yield of a crop.

Figure 5. Effects of weeds on crop yield



(i) For weed A in figure 5, describe the effect of weed numbers on crop yield.

AS WEED Nos ↑ CROP YIELD ↓

2

Examiner's use only

(ii) Explain how weed A could affect the crop yield described in (i) above.

COMPETES WITH CROP FOR NUTRIENTS, SOIL WATER AND SPACE. ALSO COMPETES FOR LIGHT

2

(iii) Give TWO reasons to account for the different effect weed B had on crop yield compared to that of weed A in figure 5.

GROWTH HABIT OF WEED e.g. - LARGE LEAVES (RED. LIGHT TO CROP)

ALLELOPATHIC AFFECT, WEED MAY BE ALT. HOST

3

(c) (i) Explain how micro-organisms provide a link between materials in the atmosphere, the soil and the plant.

MICROBES CONVERT ATMOSPHERIC NITROGEN IN ONE SOIL TO AMMONIUM IONS AND NITRATES WHICH ARE USED BY PLANTS TO FORM PROTEINS, TAKEN IN BY THE ROOTS.

4

(ii) Complete the diagram below so that it represents ONE of the links in your answer in (i) above.

INPUT	PROCESS	OUTPUT
ATMOSPHERIC NITROGEN	NITROGEN FIXATION	AMMONIA

3

(iii) Briefly describe how the output named in (ii) above is recycled into the form of the input named in (ii) above.

AMMONIA THROUGH NITRIFICATION IS CONVERTED TO NITRITES TO NITRATES. DENITRIFICATION RETURNS N_2 TO ATMOSPHERE.

2

(iv) Describe a management strategy which affects the process described in (ii) above.

INOCULATE LEGUME SEEDS WITH SUITABLE STRAIN OF RHIZOBIUM BACTERIA TO HELP N FIX.

2

QUESTION 3.

The results below were recorded in a trial to examine the effect of time of sowing on the yield of grazing oats.

Table 2. Sowing time and yield of oats

Time of sowing	Oat dry matter yield (t/ha)	
	First harvest (7 weeks after sowing)	Second harvest (13 weeks after sowing)
Mid February	2.6	2.5
Mid March	2.0	2.5
Mid April	1.7	1.7

Examiner's use only

(a) (i) From the data provided in table 2 above, when would be the best time to sow oats?

Mid-February, February 1

(ii) Give TWO reasons why the yield in this trial depends on the time of sowing.

If sown too late, cold soil temps. affect germination

Soil moisture must be adequate for germination 2

(iii) Explain why a researcher investigating the yield of grazing crops would harvest more than once.

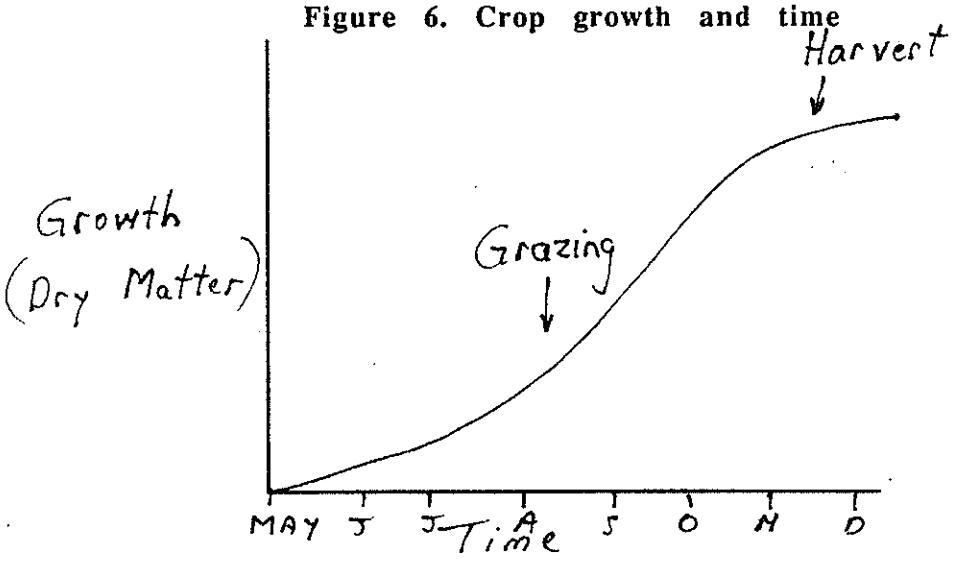
To simulate multiple grazing 2

5

(b) Name a crop you have studied Wheat

(i) Using the axes provided below, illustrate the growth of your named crop over time. Label the axes and provide a scale for the time axis. Indicate the time(s) of harvest with an arrow.

Figure 6. Crop growth and time



1 axes
2 scale
3 curve
4 harvest point
} 4

Examiner's use only

(ii) How is the best time to graze or harvest this crop determined?

- When the grain has completely filled and moisture content is only 10-12%. 2

(iii) Describe ONE factor which influences the time this crop is actually planted.

(1) Sow late enough so flowering occurs after the latest frost (2) Soil moisture must be high for germination (3) Flowering responds to increasing day length. 2

(iv) Name a pest OR disease OR weed which normally has to be controlled in this crop.

Bunt 1

(v) At what stage of the growth of this crop is the pest, disease or weed you named in (iv) above likely to be a problem?

After emergence to grain filling period. 1

10

Examiner's use only

(vi) Evaluate the effect of the pest, disease or weed named in (iv) on crop production. * biological + subsequent economic effect.

Bunt balls appear in grain and foetid odour results. Grain deliveries with any trace of bunt are rejected by AWB ∴ no return 2

(vii) Describe TWO factors you would consider before advising a commercial grower about controlling the pest, disease or weed in this crop.

Economic considerations - likely loss compared to cost of control - is bunt prevelant in the area. (economic threshold)
Biological - side effects / residual problems with use of biticide - alternate methods available? 4 (2 each)

(c) By using an example in each case, describe how the breeding of a plant or animal has influenced:

(i) resistance to disease;

selection of varieties / breeds and breeding to develop types resistant to disease eg Wheat - rust resistance
Zebu cattle - tick resistance 2

(ii) the economic yield;

breeding programs to select + concentrate factors of increased productivity eg broiler chickens ↑ growth dwarf wheats ↑ grain output.
porkers ↑ FCR
Friesian cattle ↑ milk output 2

(iii) adaptation to the environment. Merino fleece quality

development of varieties / breeds more suited to conditions
eg AM2 ↑ sweat glands for heat tolerance + drought tolerant wheats etc. 2

(d) For ONE of your answers to (c) above, describe the breeding program used to develop a new variety or breed.

AM2 - selection of Zebu (Sahiwal + Sindhi) cattle for heat tolerance + tick resistance x Jersey for milk quality + quantity. F_1 generation test bulls for heat + tick tolerance, progeny test of daughters for milk prod^n to p 5% retained for breeding, test of F_2 on progeny. 3

* 2 marks on program of breeding
1 " selection of characteristics

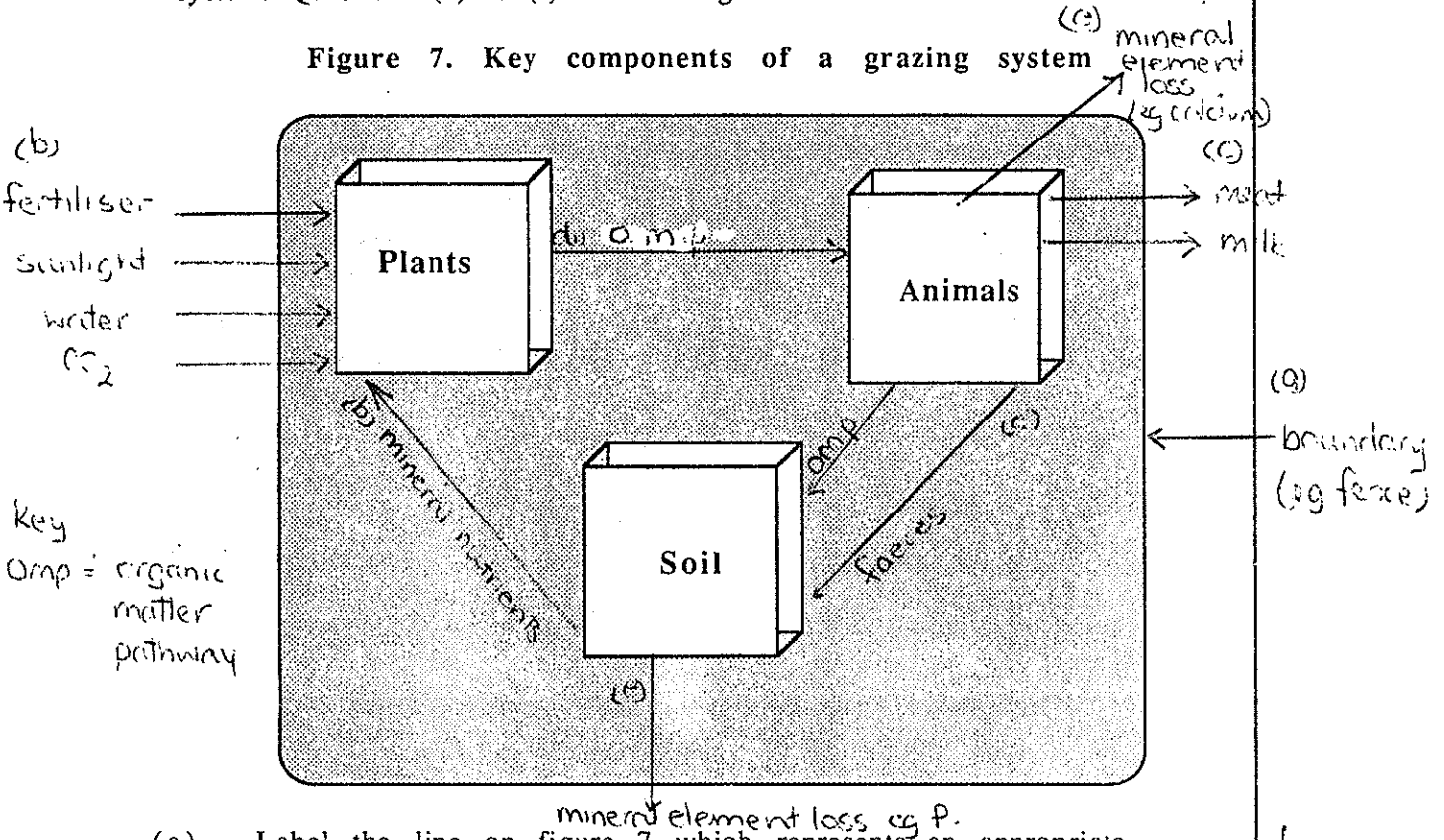
15

QUESTION 4.

Examiner's use only

The boxes in figure 7 below represent three key components of a grazing system. Questions (a) to (f) refer to figure 7.

Figure 7. Key components of a grazing system



(a) Label the line on figure 7 which represents an appropriate boundary for the system. 1

(b) Draw and name on figure 7 one input required by plants. 2

(c) Draw and name on figure 7 one output originating from the animal system. 2

(d) (i) Draw and label on figure 7 as "organic matter pathway" ONE way by which organic matter derived from plants and eaten by animals enters the soil. Be sure to label all the lines you draw. 2

(ii) Name and describe ONE of the processes occurring on your organic matter pathway by which plant material is changed.

Decomposition - faeces from animals is broken down by micro-organisms and invertebrates. The elements and minerals it contains transfer back to the soil. 3

10

Examiner's use only

(e) (i) Draw and label on figure 7 as "mineral element loss" the movement of a named mineral element out of the system. 2

Name of element Calcium | Phosphorus 1

(ii) Name and describe the process which causes this loss.

Calcium is incorporated into milk during milk synthesis and then lost to the system when the milk is sold. | leaching - the phosphorus is lost when dissolved in water which percolates through the soil horizons, to a level where plants can't use it. (as an ion) 2

(f) In this part, we want you to look at your completed version of figure 7 and imagine you are talking to a friend about what the model means to you. Write out how your conversation might go. Include a description of the labels and pathways you have included on figure 7.

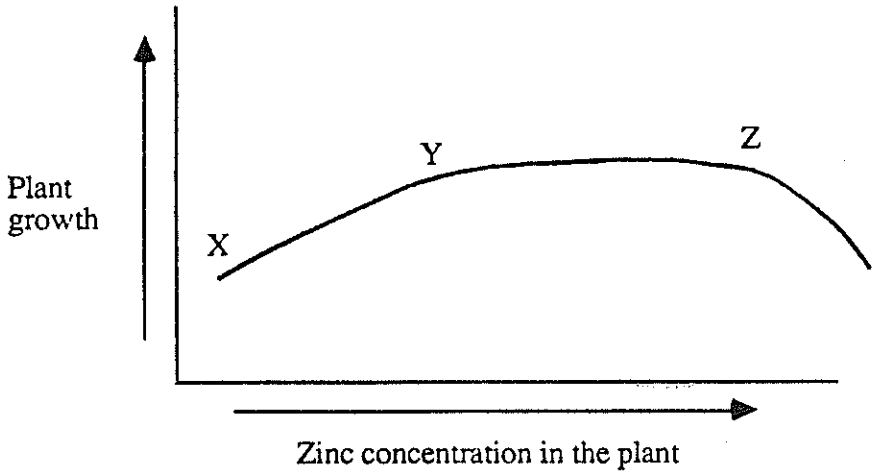
This model shows a system operating within a farm physical boundary (fence line) and has 3 main subsystems - plants, animals and soils. These sub-systems are linked by a common "organic matter" pathway whereby nutrients are cycled as different processes occur (such as digestion, mineralisation, photosynthesis, etc). The system only operates if the necessary inputs are provided eg water, sunlight and CO_2 for the plants, and fertiliser for soil. When these are provided adequately, the system functions and outputs are obtained eg beef, milk & wool. These outputs leave as products sold and take with them minerals that are therefore lost from the system. 7

12

Examiner's use only

(g) Figure 8 represents the results of a trial to measure the relationship between plant growth and the amount of zinc in the soil. This relationship was measured by sampling the amount of zinc in the plant.

Figure 8. Plant growth response to zinc



(i) Explain why plant growth is increasing between points X and Y in figure 8.

Up until point Y, zinc is a limiting factor thus plant growth increases as the conc in plants of zinc increases 2

(ii) Explain why plant growth declines after point Z.

After point Z, the concentration of zinc is too high and becomes TOXIC which has a detrimental effect on plant growth 2

(iii) Explain the steps you would go through to determine the optimum level of zinc application, starting with the information provided in figure 8.

From the graph, maximum biological yield occurs between Y and Z. Set up a field trial (using the correct biometrical techniques) with a range of zinc concs between these levels and (measure) observe for best growth. The cost of zinc application and the value of the output must also be considered to find the optimal economic level of zinc application (ie where MC=MR) 8

QUESTION 5.

Examiner's use only

The manager of a property called "Eureka Downs" consulted the local livestock officer for information about the relationship between stocking rate and liveweight gain for cattle. The following information was received.

Table 3. Stocking rate and liveweight gain

Stocking rate (steers/ha)	Daily liveweight gain	
	kg per steer	kg per hectare
0.5	1.0	0.5
2.0	0.5	1.0

(a) (i) From table 3 above, describe the effect of increasing stocking rate on:

(A) weight gain per steer DECREASE IN WEIGHT GAIN ↓ GOES DOWN 1

(B) weight gain per hectare INCREASES, IMPROVES ↑ GOES UP 1

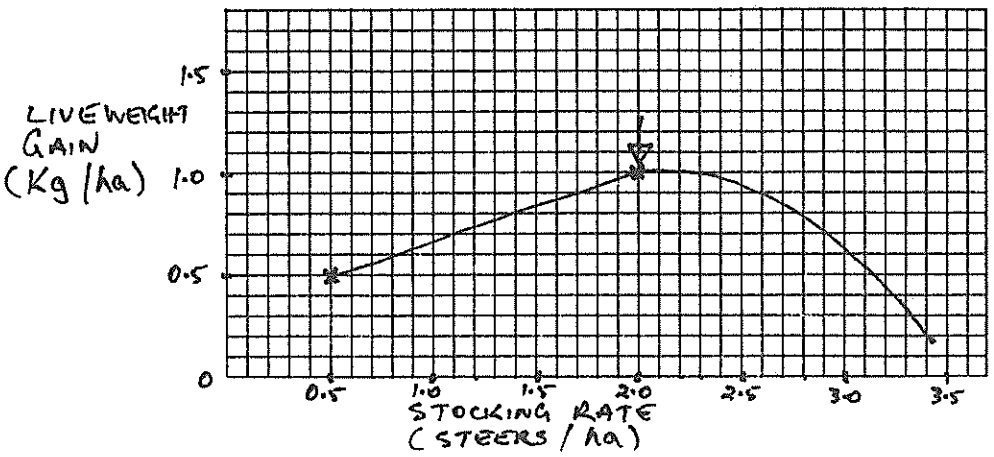
(ii) Explain why the effect described in (i) (A) above occurs.

COMPETITION FOR AVAILABLE FEED, TRAMPLING, FOOD SPOILAGE — EFFECT AND EXPLANATION NEEDED FOR 2 MARKS 2

Examiner's use only

(b) (i) Graph the data for daily liveweight gain per hectare on figure 9 below. Label the axes. Allow room for answering (b) (ii).

Figure 9. Stocking rate and liveweight gain per hectare



1 FOR
* CORRECTLY LABELLED AXES
* CORRECT UNITS ON AXES
* CORRECT SCALE
* CORRECT SHAPE

4

(ii) Extend the graph you have drawn, to show how its shape would change as stocking rate continues to increase.

SHOULD SHOW A FLATTENING AND A DECLINE

2

(iii) Label the point of maximum biological yield on your graph with an arrow.

HIGHEST POINT OF THE GRAPH

(iv) What information would the farmer need to determine the optimum economic production level?

MARGINAL COST OF INPUT = MARGINAL RETURN

GROWTH IN PROFIT = 0

2

(c) Describe TWO possible effects of maintaining a high stocking rate over a period of years.

LIST AND AMPLIFY THE TWO EFFECTS. THESE COULD INCLUDE INCREASE IN DISEASE, PASTURE SPOILAGE, TRAMPLING, SOIL EROSION, DECREASED SOIL FERTILITY, SELECTIVE GRAZING EFFECTS

4

Examiner's use only

(d) Explain how knowledge of changing pasture quality influences grazing management.

CHANGE IN QUALITY DURING LIFE CYCLE OF PLANT

WHAT CAN BE DONE ABOUT THIS EG. ROTATIONAL

GRAZING, USING DIFFERENT CLASSES OF LIVESTOCK, ALTERING

STOCKING RATE. 3

(e) The diet of ruminants is based on eating pasture. Name the organs of the ruminant digestive system which utilise the pasture and the processes which take place in them.

(i) Digestive organs

RUMEN (MUST BE MENTIONED) PLUS THREE OTHER

ORGANS EG. OMASUM, ABOMASUM, SMALL INTESTINE 2

(ii) Processes

MICROBIAL BREAKDOWN, ABSORPTION, CHURNING,

HYDROLYSIS, ENZYME FOOD SPLITTING, FERMENTATION 3

(f) Compare the feed conversion ratios of monogastric and ruminant animals.

MONOGASTRIC ANIMALS HAVE A LOWER FOOD CONVERSION RATIO EG 3:1 IN POULTRY AND RUMINANTS HAVE HIGHER FOOD CONVERSION RATIO EG 10:1 IN CATTLE 2

(g) Explain why intensive animal production is based on monogastric rather than ruminant animals in most cases.

A SOUND EXPLANATION REQUIRED INVOLVING

REFERENCE TO REPRODUCTIVE RATE, FOOD CONVERSION RATIO,

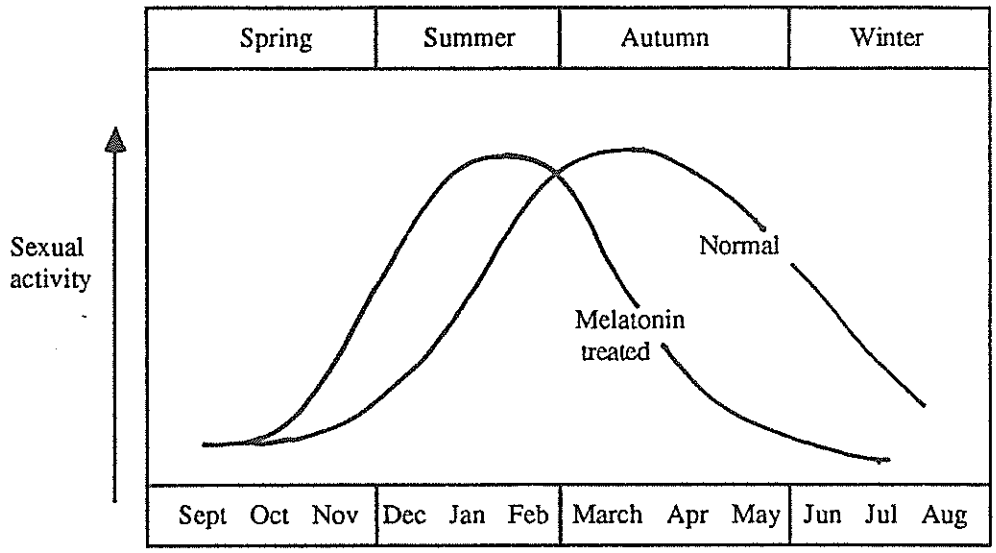
GENERAL SMALLNESS OF SIZE, VOLUME OF FOOD CONSUMED. 3

QUESTION 6.

Examiner's use only

The hormone melatonin has been found to modify the seasonal patterns of reproduction in sheep. This is shown in figure 10 below.

Figure 10. Seasonal patterns of reproduction



(a) From the information provided by figure 10, indicate the season in which sexual activity normally occurs.

Autumn (accepted months or curve description) 1

(b) State TWO changes in the pattern of reproduction which are represented in figure 10 as a result of treatment with melatonin.

Sexually active earlier in Summer
sexually active period is narrower 2

(c) For a hormone system you have studied,

(i) name an important hormone any hormone (plant, animal, synthetic) 1

(ii) describe its function.

Function had to be correct
related to the named hormone 3

Examiner's use only

(d) For an animal production system you have studied, list THREE factors, other than hormones, which affect reproductive performance.

Temperature, genetics, age, nutrition disease, stress + seasons etc — 3

(e) Seasonal reproduction in sheep results in more lambs being marketed in summer (as a result of autumn joining) than in spring. However, consumer demand for lamb is fairly constant throughout the year.

(i) Explain whether you would expect the price of lamb to be higher in summer or early spring.

higher in spring due to decrease in supply — 2

(ii) A hormone like melatonin, if commonly used, could change the supply of lambs coming on to the market in spring. Describe the effect this would have on the spring price for lamb.

price decreases due to increase in supply. — 2

(iii) Describe the changes which might occur in the price of lamb throughout the year as a result of the widespread use of melatonin.

less price fluctuations throughout the year — 2

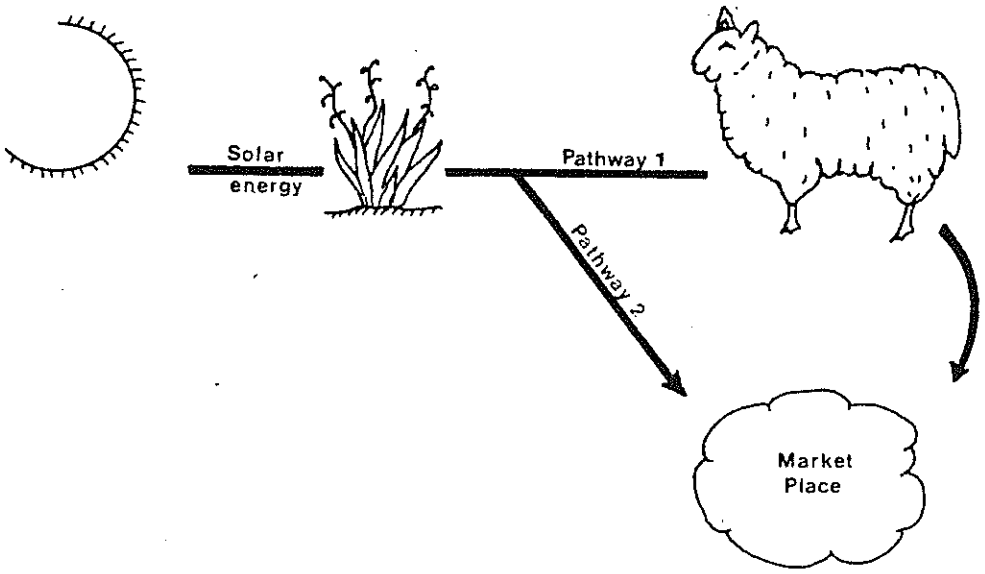
(f) Outline TWO management strategies which could be used to improve the overall price received for a product.

Produce better quality product
Timing of marketing; Advertising
Improve technology; Improved disease control/health — 2

Examiner's use only

(g) The movement of energy through agricultural production systems to the marketplace may follow one of two pathways. This is illustrated in figure 11 below.

Figure 11. Energy pathways in production systems



(i) Compare the energy arriving at the market place through pathway 1 on figure 11 with that arriving through pathway 2.

greater energy lost in pathway 1 as greater concentration of energy in pathway 1 2

(ii) Describe TWO advantages of following pathway 1.

Variety of product; unusable inputs are synthesized into more usable forms eg. digestible products to humans; improvement in protein quality 4

Examiner's use only

(h) Answer (i) and (ii) below for a production system you have studied.

Name of production system _____ 0

(i) Name a micro-organism or an invertebrate which causes spoilage of the harvested product, resulting in energy loss from the production system.

Organism must relate to post harvest product 1

(ii) Describe the damage this organism causes to the product.

adequate description of post harvest spoilage or in the case of pre-harvest spoilage then it must show how post harvested product is spoiled 4

SECTION III

Attempt TWO questions.

Recommended time - 60 minutes

QUESTION 1.

You have been asked to talk to a class of younger students who do not study Agriculture about the operation of your school farm, or a farm which you have visited. Write a set of notes which would help you to achieve this task. The purpose of the talk is to:

(a) outline the activities which occur on the farm;

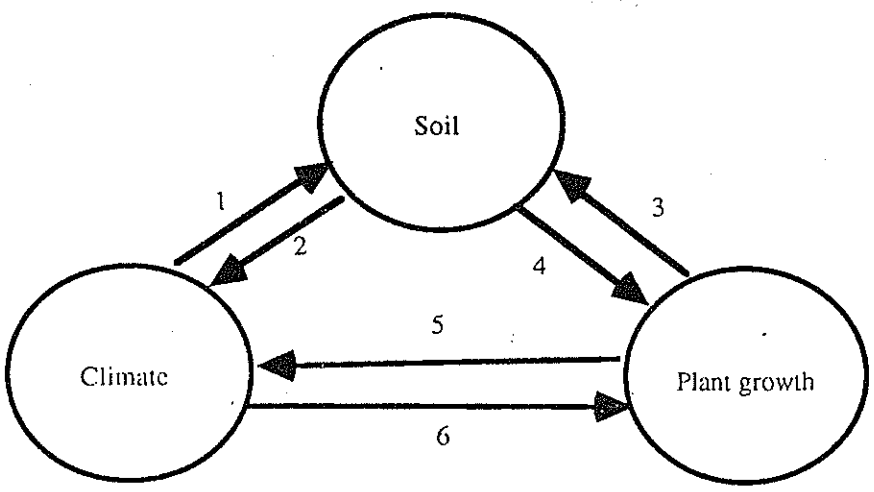
(b) explain how one or two of the practical activities you have carried out on the farm have helped your understanding of some aspects of agriculture and

(c) describe a skill you have acquired which will better help you to look after plants or animals.

QUESTION 2.

Soil, climate and plant growth interact with each other in agricultural production systems. This interaction is represented in figure 12 below.

Figure 12. Interactions in production systems



Outline one important influence of each of these subsystems on the other. Identify the influence you are describing by referring to a number on figure 12. Using examples, describe those influences which respond to management.

QUESTION 3.

The productivity of animal production systems depends on the interaction of the genetic makeup of the animal and the environment in which it is grown.

(a) Explain how productivity can be improved by altering the environment in which the animal is grown. Support your explanation by using examples from a specified production system.

(b) Describe how selective breeding can be used to alter the genotype of the animal to better suit the environment. Illustrate your description by selecting examples of the use of this approach in an animal production system in Australia.

QUESTION 4.

For a particular farm animal with which you are familiar:

(a) outline a suitable ration for this animal;

(b) describe the role of each component of the ration;

(c) describe what variations to the ration would be necessary to make it suitable for

(i) younger stock and
(ii) older stock;

(d) describe how the ration could be modified in order to change the carcase composition of the animals.

QUESTION 5.

Some Australian agricultural products are controlled by rigid marketing procedures, while others are sold into a market which is virtually free of control. For an agricultural product you have studied, outline:

(a) the marketing procedure for the product;

(b) the effect the marketing procedure has on the management decisions made by the farm manager and

(c) the effect of these management decisions on subsystems within the farm.

QUESTION 6.

Agricultural practices may lead to changes in the soil which reduce productivity in the long term. Outline some of these changes and explain how agricultural practices may cause them.

QUESTION 7.

Interference is a natural part of plant communities.

(a) Outline the major components of interference in plant communities.

(b) Explain how at least one of these components can be manipulated to increase yield, illustrating your answer with examples where possible.

(c) Describe an experiment you have conducted to measure the effects of interference.

QUESTION 8.

Draw a systems model or diagram which shows the physical, biological and socio-economic inputs into a farming system with which you are familiar. Explain how the inputs you have identified interact to determine one type of production occurring in the area in which your farming system is found.

QUESTION 9.

Agricultural production systems are not always in balance with invertebrate and microbial populations. Suggest some reasons why this situation occurs. What strategies do farmers use in an attempt to regulate this imbalance in the short term and in the longer term?

EXAMINER'S USE ONLY

Section II	Marks	Marks Checked	Section III	Marks	Marks Checked
Question 1			Question 1		
Question 2			Question 2		
Question 3			Question 3		
Question 4			Question 4		
Question 5			Question 5		
Question 6			Question 6		
Total Section II			Question 7		
			Question 8		
			Question 9		
			Total Section III		

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Tree Maze

d	o	p	i	s	h	a	d	e	e	h	o	c
g	a	n	e	d	l	o	g	s	g	d	a	s
s	t	r	e	e	r	d	a	u	n	r	d	b
f	a	l	l	e	n	e	o	o	e	d	e	r
l	l	n	e	s	t	r	a	i	g	h	t	a
o	l	g	a	a	t	u	o	d	y	o	a	n
w	n	b	f	o	d	t	d	o	x	l	r	c
e	e	a	r	t	h	x	b	o	o	l	r	h
r	e	r	a	t	c	e	n	u	o	o	e	e
s	r	k	f	a	s	t	m	u	d	w	s	s
g	g	o	t	u	h	t	o	o	m	s	o	o
o	o	e	d	a	m	m	o	s	s	o	l	b
d	b	r	o	w	n	e	l	l	o	p	i	l

See if you can find the following 35 tree words in a straight line in any direction in the maze above:

tree	blossom	earth	log	seeds
mud	care	moss	red	wood
pollen	oxygen	food	green	shade
leaf	sap	serrated	pod	nest
flowers	hollows	smooth	textured	bark
buds	branches	tall	golden	rough
nectar	brown	straight	rot	fallen

List all of the other words you can find.

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.

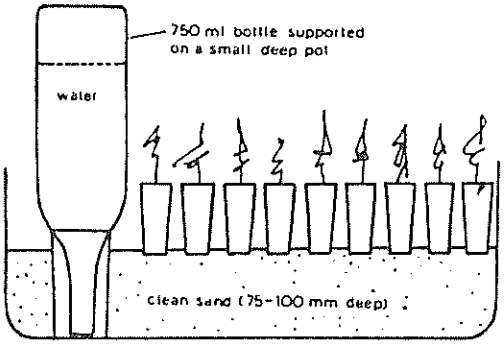
Not all seed germinates easily, however, and the beginner would be well advised to select from that which has proven to be reliable (e.g. wattle, bottlebrush, Eucalypt, Banksia, Hakea, Casuarina.....to name just a few).

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

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'phone :- (02) 525 7484

.../2

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.

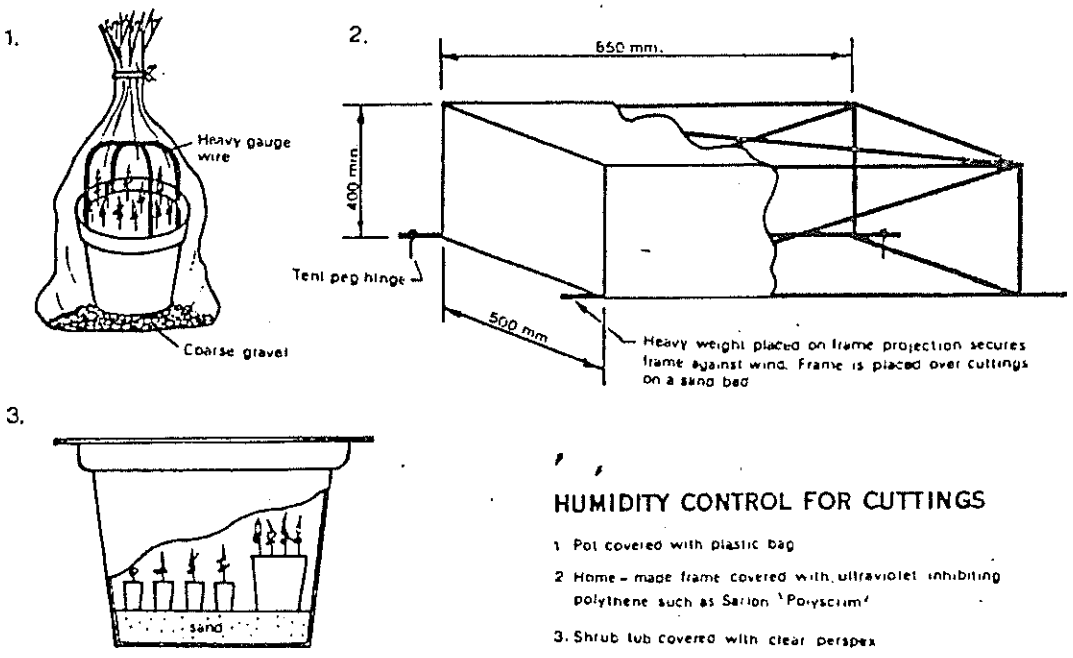
Planting out. Plants will be ready for the garden when good root development has occurred. This can be checked by carefully tapping the plant out of the pot. Plants should not be allowed to become pot-bound.

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

.../3

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

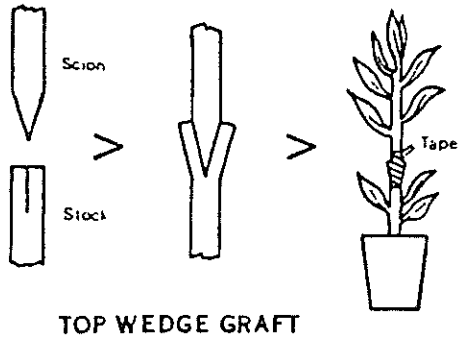
Grafting is not usually thought of as a method for the home gardener. However, the techniques involved are not difficult and are well within the scope of anyone who has mastered propagation by cuttings.

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

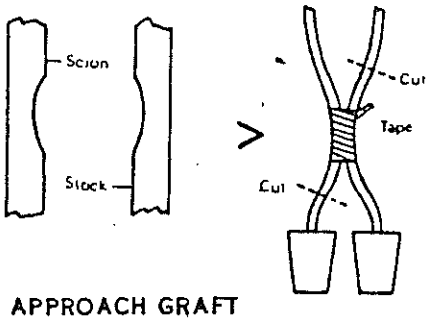
the cambium layer of each is in contact.

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).



Eucalyptus Propagation

INTRODUCTION

This article is reproduced from a leaflet entitled "Eucalypt Propagation on a Small Scale", by David Kleinig and John Doran, available from the C.S.I.R.O. Permission to republish it is appreciated, and the fine work of the C.S.I.R.O. in the improvement of quality of living in Australia is acknowledged.

The recommendations are based on the experience of officers of the Division of Forest Research, C.S.I.R.O., in producing small numbers of seedlings for research. The techniques described are not the only ones possible, and would be modified for producing large numbers of plants.

SEED AND SEED STORAGE

Most commercial eucalypt seedlots are sold, stored and sown as a mixture of viable seeds and chaff (mainly unfertilised ovules), which are difficult to separate in many species. The main features are the very small seed size of most species, the high proportion of chaff (from 5:1 to 30:1 by weight), and the similarity in size, shape and colour of the chaff and viable seeds of some species. The average number of viable seeds per gram of seed and chaff varies greatly with species and is in the range of seven to 4,000.

Eucalypt seeds are relatively easy to store. The mature seeds of most species remain viable for a decade or more when stored at a moisture content below 10% in sealed containers at room temperature. In dry climates, air drying of the seeds during extraction will give a satisfactory seed moisture content for storage (8-10%). In humid climates, however, air drying of the seed may leave the moisture content undesirably high for storage, although this can be partly offset by storage at lower temperature (1-4°C). Long-term maintenance of viability is better assured if seeds at a moisture content of less than 10% are refrigerated in sealed containers at 1-4°C. This treatment is essential for the successful storage of seed of *Eucalyptus deglupta* and *E. microtheca*.

CONDITIONS FOR GERMINATION

Temperature, Moisture and Light

Most eucalypt seeds germinate over a wide range of temperatures, generally 10-30°C. The optimum temperature for germination of most species is close to a constant 25°C, with some tropical species tending to have a higher optimum temperature and some temperate species a lower optimum. High humidity around the germinating seeds is essential, and they should be exposed to a period of light each day.

Stratification

The seeds of most eucalypt species germinate readily without preliminary stratification treatment when given appropriate conditions of temperature, moisture and light. However, seeds of species from high altitudes commonly require cold, moist stratification to break their dormancy. To stratify, sow the seeds in the moist substrate in the germination container (as described below), cover the container with a lid or a plastic sheet to minimise drying, and place in a refrigerated environment at 1-4°C. Check occasionally to see that the substrate remains moist.

Three (3) weeks of stratification is essential to break the dormancy of seeds of *E. perriniana* and will also ensure more rapid and even germination of seed of *E. amygdalina, E. dives, E. nitens, E. pauciflora* ssp. *pauciflora, E. regnans* and *E. stellulata*. Four (4) weeks of stratification is essential for the germination of seeds of *E. glaucescens* and *E. pauciflora* ssp. *niphophila*; six weeks is required by *E. kybeanensis, E. mitchelliana* and *E. pauciflora* ssp. *debeuzevillei*, while *E. delegatensis* requires 6-10 weeks, depending on seed source. On subsequent transfer to warmer temperatures germination should commence within 3-5 days.

RAISING SEEDLINGS

A two-stage approach is recommended. This involves sowing a quantity of seed in a germination container, and then transplanting individual seedlings from this container into separate pots for growing on to the planting-out stage. Usually eucalypts grown in pots will transplant much more successfully to the field than seedlings taken as bare-rooted plants from a nursery bed.

Sowing

The time for this depends on local conditions, particularly on the optimum time for planting-out. For example, in Canberra sowing in the glasshouse in May allows the production of vigorous stock for planting-out in September-October after the last of the severe frosts and well before the hot, dry summer.

Choose a germination container of convenient size and depth. Plastic pots 7.5 cm in diameter are suitable for germinating 20-30 seedlings, and plastic trays 14 x 8 cm for 50-60 seedlings.

Suitable sowing mixes include 2:1 vermiculite and perlite, or 1:1:1:1 coarse sand, peat moss, vermiculite and perlite. If these materials are not readily available, a 1:1 mix of sand and loamy soil, or even a medium grade sand, will suffice. Heat sterilisation of all mixes is desirable. Nutrients are necessary once the cotyledons of the seedlings have developed, and can be provided by a slow-release fertilizer such as "Osmocote" or "Magamp" in the mix, or by regular weekly application of a liquid fertilizer such as "Aquasol". Suitable rates are given in the section on transplanting.

The sowing mix should be watered before sowing and the seeds sprinkled sparsely and evenly over the surface. Care is necessary to avoid sowing too densely, as this will result in unsatisfactory spindly seedlings. The smaller eucalypt seeds do not need to be covered, but larger seeds should be covered with a layer of the sowing mixture no thicker than the diameter of the seed.

Germination trays should be kept in a warm (20-25°C) shaded area (50-80% shade). A glasshouse is preferable but a sheltered shadehouse or verandah can be used. The trays should be watered at frequent intervals with a fine spray, so that the sowing mix is kept moist but not saturated. If "damping-off", the rotting of seedlings by soil fungi attacking at soil level is suspected (most common soon after germination), spray with an appropriate fungicide such as "Benlate" or "Captan".

Transplanting

The most convenient stage for transplanting is about 5-7 weeks after sowing, when the seedlings have 1-2 pairs of leaves above the cotyledons.

Containers of many types and sizes are suitable for transplanting eucalypts. For example, black polythene bags, 10 cm diameter and 14 cm deep (about 1.5 litres) are adequate for raising plants to 25-30 cm in height and are readily available. Other containers in common use include polythene tubes, plastic pots and peat pots of varying capacities.

A potting mix of adequate water-holding capacity, while still allowing good drainage, is essential for optimum plant development. Two such mixes

that are suitable are:

(a) 1:1:1 coarse sand, sandy loam and peat moss;
(b) 1:1:1:1 coarse sand, peat moss, vermiculite and perlite. Nutrients can be conveniently provided by the inclusion of "Osmocote" or "Magamp" in the mix at the rate of 1.75 kg/m³ (17.5 g/10l), or by the regular application of a liquid fertilizer such as "Aquasol". If fertilizers are not readily available, the inclusion of well-decayed animal manure in a mix with coarse river sand, and sandy loam in the proportions 1:2:3, is recommended.

The technique for transplanting into the separate containers is:

(a) Fill the containers with potting mix and water thoroughly.
(b) Take each container and prepare a hole in the mix with a "dibbler" (a pointed tool like a pencil). This hole should be about 1-2 cm in diameter and 2-3 cm deep.
(c) Using the dibbler, carefully prise a group of seedlings out of the sowing container and detach an individual seedling. Handle the seedling by its leaves only and avoid squeezing the stem. Roots are frequently quite long and should be pruned back to a length of 2-3 cm. Care must be taken to prevent the root system folding upwards as it is placed in the hole. Hold the seedling at the side of the hole so that the topmost roots are a few millimetres below the soil surface and gently firm the soil around the root system with the dibbler.
(d) Water gently after transplanting to ensure complete soil contact with the roots.

TENDING AFTER TRANSPLANTING

Initially plants should be kept in a shaded, weatherproof environment. Damage from heavy rain, wind, hail and frost can be very severe. Frost damage is less likely if the plants are on benches rather than at ground level. A permanent shadehouse is desirable, though temporary, portable covers of "sarlon" shade-cloth, hessian or similar material can be quite adequate. The need for shade after the first 2-3 weeks will depend on climate and season. Too much shade should be avoided, as it promotes the development of weak, spindly seedlings.

The potting mix must be kept moist, but not saturated, and never allowed to dry out. Before planting out, the seedlings should be "hardened off" by reducing the watering slightly and increasing the exposure.

Pathogenic fungi, insects and other injurious agencies can cause problems. The treatment of damping-off has already been described. Leaf diseases, including mildews and moulds, can also spread quickly; treatment with "Benlate" spray or dusting with sulphur powder often provides satisfactory control. Obviously it is better to prevent fungal problems by adequate ventilation, heat sterilisation of the potting mixes and good hygiene rather than to attempt often-too-late control with fungicides. Pyrethrum-derived sprays and dusting powders, which are not toxic to man, have been found most useful in controlling a number of insect pests, particularly aphids.

About 2-3 months after transplanting, seedlings should be 25-30 cm tall and ready for planting in the field.

Propagation for the Home Gardener

By THE EDITOR

The propagation of eucalypts from seed is quite easy if the seed is reasonably fresh. It is keeping the seedlings going that is the tricky part. For those who do not want to go to too much trouble, and do not care if they lose a few seedlings (after all, who wants more than a few plants of a species of large gum tree), this method is recommended:—

1. Sow seed only between April and June—send for seed now.
2. Prepare small plastic pots or tubes, crocked at the bottom, with 2 cm of clean, washed, coarse sand over a sandy loam soil in the bottom of the pot.
3. Sprinkle about 10 seeds on the top of each pot and cover lightly with more sand or fine gravel.
4. Water by dunking the tube up to halfway in a container of water. Water will seep up to the top, moistening the seed.
5. Keep the tubes in a bright spot, but with no direct sun. Keep, say, the tubes for one species together in a plastic ice-cream container and keep this on a window-sill—inside, away from the wind.
6. As seedlings shoot up, prick out all except the most vigorous one.
7. Pot on to large pots when the seedling is half as high as the depth of the tube, or pot as described elsewhere in this issue.
8. So you failed—try again. There are hundreds of fine seeds in each packet. After a few trials you will find the method that suits your conditions best, and then you will have plenty of plants.
9. The main cause of failure is fungal attack from the water, or because the sand around the seedling gets too wet. Try watering the pot with boiling water before you sow the seed, boiling the water and allowing to cool before watering, keeping the surface of the sand drier, or give the surface a little direct sun for an hour a day.
10. In the early stages vigorous growth is desirable, so that a little foliage fertilizer may help when the seedlings get a few centimetres high.
11. A deep pot or tube is essential to keep that tap-root straight down and not twisted, so plant out before the height of the plant equals the depth of your large pot.

OVERSEAS SERVICE BUREAU
AUSTRALIAN VOLUNTEERS ABROAD **AGRICULTURE**

Overseas Service Bureau

The Overseas Service Bureau is an independent community organisation involved in programs and issues relating to world development, particularly in the assignment of volunteer development workers in the Third World.

The OSB has, as one of its programs, Australian Volunteers Abroad (AVA). AVA positions are for a minimum of two years overseas. OSB pays the return airfare, plus a settling-in and a resettlement allowance. The OSB also arranges insurance cover for AVA's.

Whilst overseas, AVA's are paid the equivalent of local salary by the overseas employer. The employer is also responsible for arranging accommodation.

Requirements for AVA's

AVA's must be Australian citizens or have permanent residency status. They must be Australian-based for a series of meetings and briefing prior to departure. Overseas employers require that AVA's have recognised trade or professional skills and at least two years' work experience.

Positions in Agriculture

Requests are received each year for people with agricultural skills - livestock specialists, crop specialists, agriculturalists, foresters, fisheries officers, farm managers for agricultural projects, horticulturalists, researchers. It should be noted that requests from overseas employers vary and that in any given year there may not be requests for a specific skill area.

AVA's have previously worked, or are working as:

Forestry Officers
Livestock Project Managers
Advisors on Animal Husbandary
Farm Managers
Lecturers and Teachers
Extension Officers
Soil Surveyors
Soil Conservationists
Agricultural Economists
Fresh Food Officers
Fisheries Officers
Horticulturalists

It is expected that the OSB will continue to receive requests for AVA's with professional qualifications and experience to work in each of the areas listed above.

Countries

AVA Agriculturalists have worked or are working in:

Sri Lanka, Malaysia, Botswana, Tanzania and countries of the Pacific - Western Samoa, Vanuatu, Fiji, Cook Islands, Papua New Guinea.

Notes

The AVA Program offers agriculturalists an opportunity to contribute their skills to overseas communities as well as broaden their knowledge of different agricultural techniques and issues: subsistence farming, tropical and atoll agriculture, cash-cropping, dry-land farming. The project may involve beginning from scratch, or developing an exisiting program. Often agriculturalists work in isolated areas: they need, therefore, to be resourceful.

There are two main departures each year, in January and July. People wishing to apply as a couple should both complete an application form. Accompanying children should be listed thereon

Joint applications are required to have five (5) confidential statements in all on their behalf (i.e. a joint one from someone who knows both partners well plus two individual ones each). Single applicants are required to have three (3) confidential statements on their behalf.

Further Information

Melbourne	(03)	419-1788
Sydney	(02)	267-5452
Brisbane	(07)	891-1168
Adelaide	(008)	331-292
Perth	(09)	271-7691
Darwin	(089)	854-959
Tasmania	(004)	24-9363

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