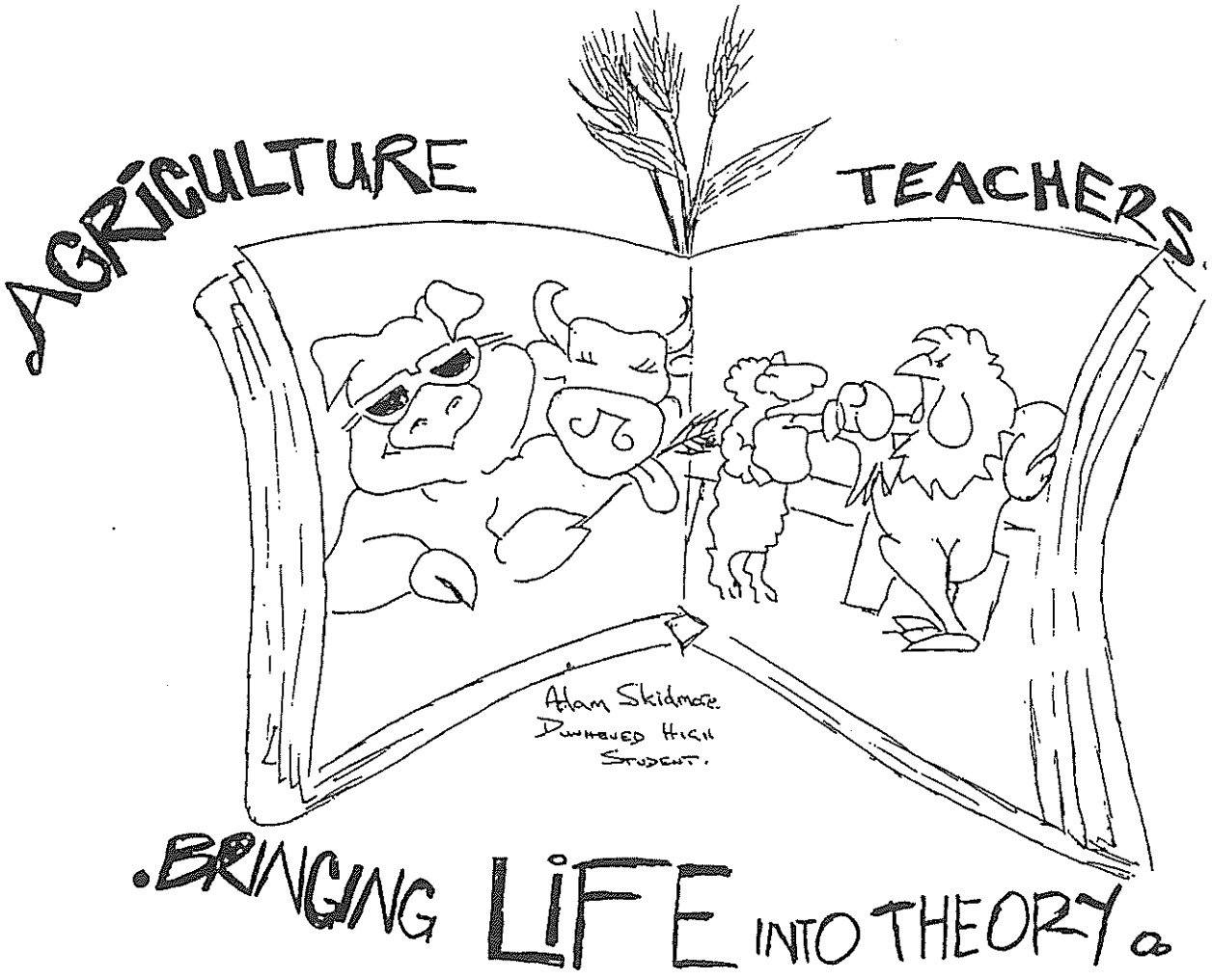
BAAT

Bulletin of the NSW Association of Agriculture Teachers



Number 2
September 1991

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EDITORIAL

Well edition 2 has hit the stands . What I have tried to concentrate on this time is to provide you with materials that might make life a little easier for you . I know things are getting hectic and any little thing that helps is going to keep you sane .
In this edition I have included a range of one of lessons , and two complete units of work on innoculation and dairying (the dairying unit being designed for the less capable student . For newer teachers a unit on classroom strategies , an inservice report on technology update , a method of promoting Agriculture , resource adds and information on design and tecnolgy .
At this point I would like to thank the small band who helped in the preparation of this material , My staff , Meg . Rhonda and John as well as Carolyn (From Northholm) . This you might gather is a little hint that more support from the wider membership would be appreciated .
Do you have a good practical , crossword , a thought , something to sell , a school report or an inservice report . SEND IT TO ME AND I WILL GLADLY PUBLISH IT .

A few important points -

Put in your calenders the following date . 6-8th May 1992 .
As a cooperative effort Met West (I Saunders - Contact) and Western Region (Michael Tom) will be running a 2 Day inservice for Ag Teachers at Orange Ag College . Any suggestions for topics for inclusion will be grateful accepted . It should be a good bash .

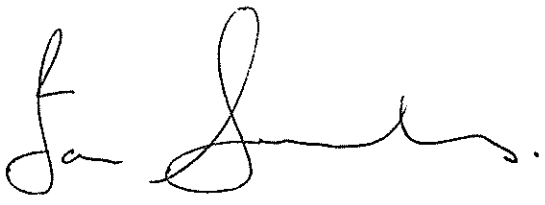
With the implementation of Design and Technology and the Key Learning TAS it is important that you become involved to ensure that Agriculture gets a fair offering in curriculum patterns . If you DONT you and your subject will be lossed .

Funding - All B4 grant money and maintenence money is controlled by Properties in each Region . Make sure you make the Heads of the respective Properties sections aware of your needs especially as the Tractor Replacement and Maintenence Programs have now been devolved to Regions .

Finally - The book - Guidelines for the Use of Animals in Schools - is now released . Each school was given a copy and the committee would be grateful to receive ALL feedback .

The final edition for this year will be released immediately the HSC is completed so that suggested answers can be published .

Ian Saunders
Editor
H/T Agriculture
Dunheved High
LOCKED BAG 19
St Marys NSW 2760



e) Treatment results were tabulated and then averages taken as well as SD. REsults were graghed and then results tested to see if significant difference between control and treatments .

f) Sowing on the surface allowed significant loss of seed to dessication and birds , sowing at 10 cm resulted in slow germination and weak seedlings .

Question 3.

a) i) The farm consisted of 100 ha of well drained .alluvial river flats that were irrigated from a bore . Lucerne was grown on thw flats that was used to feed 80 Jersey cows . Dairy consisted of conventional herring bone .

ii) Subsystem - Lucerne - Inputs , water , fertilzer , seed
Output - Lucerne hay
Subsystem - Dairy - Inputs , cattle , water , labour
Output - milk , manure

iii) A range of very simple models were excepted that labeled interactions between systems .

iv) Input - Fertilizer
The addition of Mo Super led to increased growth of lucerne crop , leading to increase in milk quality through increased protein levels in pasture.

ANSWERS TO SECTION 1 - 1990 HSC

Question 1.
a) Example - Sheep
Shearing : Aug - so ewes seek shelter prior to lambing , shearers available.
Joining : Autumn - so lambing in spring when adequate feed available - rams libido at highest level .
Crutching : 4 weeks prior to lambing to enable easy birth and lamb to find udder .

b) i) Soil : Podsol - pH 4-5 , Clay loam texture , Blocky structure , High O.M , High water holding capacity .

Climate < 650 mm of rainfall , winter dominant , Temp Range -7C - 45C

ii) Soil - Acidic nature of soil requires farmer to plant acid tolerant species and use lime .
Climate - Wheat sown in April /May to coincide with winter rain and to reduce risk of flowering when frosts are likely to occur .

c) i) Drop in wool floor price .

ii) Diversify into beef
Lower sheep numbers
Breeding with finer wooled rams as fine wool market more stable

d) i) Farm Size and managerial skills
Disease , Nutrition
ii) Stem rust decreases photosynthetic area grain production reduced

iii) Resistant varieties , crop rotation .

iv) Production increased from 4 Tonne / ha to 5.5 tonne / ha

Question 2
a) To determine whether sowing depth would significantly effect germination %.

b) Experiment was set up in a block design with each treatment area occupying 1 metre square . 5 rows of seed were sown to each block and each treatment replicated five times . 200 seeds were sown in each treatment . Experimental site was on Northerly aspect all received same preparation , coverage , method of sowing , watering and fertilizer . Timber scarifiers were used to drill seed to appropriate depths . Treatment blocks were randomly allocated and all results were compared to control (Seed depth 2.5 cm)
Treatments were 0cm , 5cm and 10 cm .
Recordings would be made 5 days after sowing then dayly after that . Time to achieve 50% germination would be recorded as well as final germination % and crop quality.

c) Replicated each treatment . Randomly selected treatment sites and seeds . Ensured all other factors that affect seed germination were constant .

d) Recorded days till 50% germination achieved , crop strength and ultimate germination %

AGRICULTURAL STUDIES AT DUNHEVED

There are many aspects to the curriculum offered at Dunheved . The subject agriculture may be studied from many different perspectives . If you wish you can study it solely by attempting the broad subject , Agriculture , both in the Junior or Senior School . Should you wish to specialize a little because of particular interests then you can attempt any number of the following subjects :-

JUNIORS

LANDSCAPE DESIGN

HORTICULTURE

LIVESTOCK MANAGEMENT

SENIORS

HORTICULTURE

LIVESTOCK MANAGEMENT

BASIC FARM SKILLS

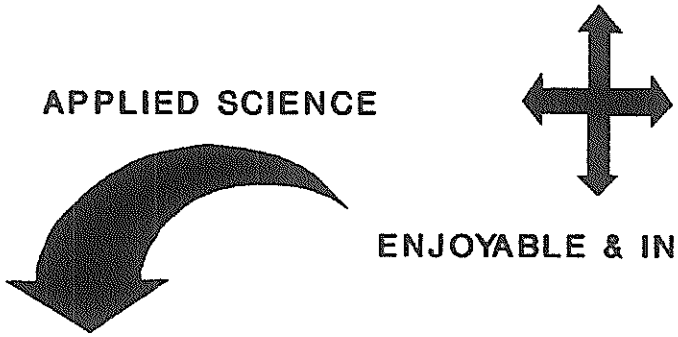
APPLIED STUDIES

ENVIRONMENTAL EDUCATION

AGRICULTURE

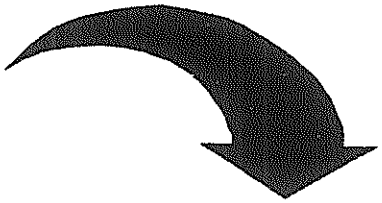
WHAT DOES IT HAVE TO OFFER YOU ?

A SUBJECT THAT IS :-



APPLIED SCIENCE

ENJOYABLE & INSPIRING



PRACTICAL

DEVELOPS UNDERSTANDING OF SCIENCE & TECHNOLOGY

DEVELOPS THINKING SKILLS

DEVELOPS LITERACY SKILLS

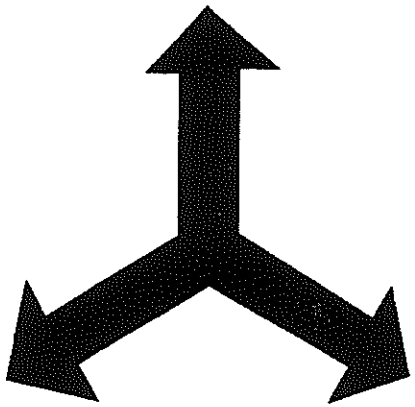
UNDERSTANDING OF THE ENVIRONMENT

ANIMAL HUSBANDRY SKILLS

PLANT HUSBANDRY SKILLS

PRACTICAL CONSTRUCTION SKILLS

HOW DOES AGRICULTURE ACHIEVE ITS AIMS ?



THROUGH DSP PROGRAMS

THROUGH COMMUNITY PROGRAMS

THROUGH ACTIVE & INNOVATIVE PROGRAMS

THROUGH FARM TOUR

THROUGH INTEGRATION PROGRAMS

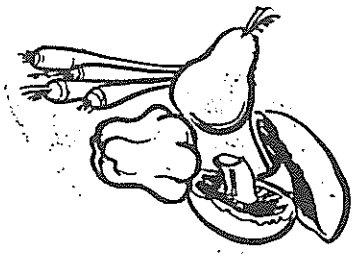
THROUGH A STUDENT CENTRED AG. PLOT

THROUGH COMMITTED STAFF

THROUGH EXTENSIVE SUCCESS IN THE AGRICULTURAL COMMUNITY
SHOWING - SHEEP,GOATS,POULTRY,CATTLE,FLOWERS & VEGETABLES

SENIOR AGRICULTURE



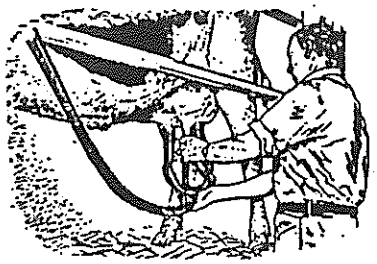


WHAT IS SO SPECIAL ABOUT AGRICULTURE?

Agriculture in Years 11 & 12 is an interesting course providing a blend of theory and practical work. It is a course in which you put into practice the information learnt in class. Dunheved has one of the best equiped and most diverse Agriculture Plots in the State, allowing unique opportunities in experiencing all aspects of Agriculture. The course is recognized by all Universities and many employers realize that Agriculture develops many worthwhile skills and thought processes wanted in employees. Agriculture also develops skills and interests that can be applied at home.

Agriculture is an Applied Science, it incorporates Biology, Chemistry, Physics and Mathematics. It gives a good grounding in all these subjects and applies them to the "real world".

Most importantly, students that study Agriculture, ENJOY IT.



WHO SHOULD CHOOSE AGRICULTURE?

Agriculture should be chosen by any student who is prepared to work hard and who values their education. It suits a wide range of students, both those that are academically gifted and those that are more practically inclined. The course is assessed on both theory and practical to allow success for any student who works for it.

Agriculture has no prerequisites and can be studied for the first time in Year 11.

WHAT DOES THE COURSE INVOLVE?

Agriculture is a 2 unit Board Developed Course, it can be use when calculating your TER on your HSC. The course will develop students through a study of factors involved in food and fibre production. It looks at the following systems and their interactions - animal production system, plant production system, resource system, microorganisms/invertebrates systems and socio-economic systems.

Lessons take place both in the classroom and on the school farm. Students will also complete laboratory work and visit commercial farms as part of the course.

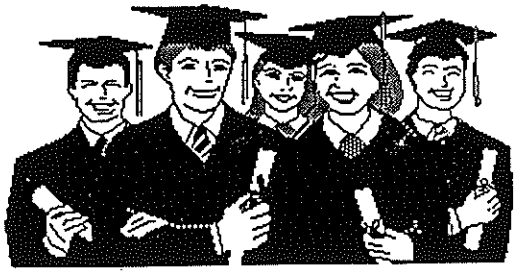
HOW IS AGRICULTURE ASSESSED?

Agriculture is assessed on the following tasks.

Practical Tests, Unit Tests, Yearly Exam, Fieldwork, Trial Exam, Practical Reports & Assignments.

CAN I DO MORE AGRICULTURE?

Yes, in Year 12 you can choose to study 3 unit Agriculture. This means an extra 3 periods of lessons each week, often studied at lunch, before or after school. It is a course for highly dedicated students who are willing to conduct a thorough research project and study the electives chosen.



WHICH TERTIARY COURSES CAN I CHOOSE?

School studies in Agriculture can be followed up by interested students by choosing any of the numerous courses offered by Tertiary Institutions.

Universities offer Degree and Diploma Courses in - Science in Agriculture, Applied Science, Agricultural Science, Rural Science, Natural Resources etc etc.

TAFE and Agricultural Colleges offer Associate Diploma, Certificate and Statement of Attainment Courses in - Horse Husbandry, Wine Science, Irrigation, Agriculture, Dairying, Horse Managment, Horticulture etc etc.



WHAT CAREERS CAN AGRICULTURE LEAD TO?

Studying Agriculture opens up many exciting career choices. Just a few of these include -

veterinarian, horticultarist, agricultural economist, agronomist, soil scientist, landscape gardener, green keeper, microbiologist, vet. nurse, groom, animal attendant, park ranger, advisor, sales representative, teacher, plant pathologist, physiologist, entomologist, picker, viticulturist, market gardener, orchardist, jackaroo, dairy hand, farm manager, plant breeder, farm hand, geneticist, field officer, ag chemist, etc etc.

NEW TECHNOLOGY IN ANIMAL PRODUCTION

REPORT ON AN INSERVICE HELD BY THE AUSTRALIAL SOCIETY FOR ANIMAL PRODUCTION, SYDNEY BRANCH, AT CSIRO PROSPECT.

Carolyn Watt, Northholm Grammar School, Arcadia.

On 27 August, Agriculture Teachers from the Sydney Branch were able to update their knowledge of the latest developments in animal production at this inservice organised through the ASAP. We were first shown a machine developed to put netting around a sheep to hold the wool after chemical defleecing.

Dr Kevin Ward spoke to us on **Genetic Engineering of Livestock.** Genetic engineering involves:

- isolating single regions of genetic information,
- cutting out specific fragments of DNA by enzymes,
- inserting the DNA into bacterial plasmids (this is now called recombinant DNA) and
- cloning the bacteria in a flask to produce massive amounts of the substance.

One use of this has been in improving body growth in sheep. "Switches" or promoters at the start of a gene have to be changed so that they work in animals, in this case so that the gene will be " switched on" by zinc to produce more protein (Figure 1). The gene is micro-injected into a sheep embryo pronucleus which is put into a surrogate mother. Of the lambs, 50% will be transgenic. Unfortunately, this has been too successful and the genes in the sheep do not switch off, as they do in mice, once zinc is removed. The sheep develop diabetes as a consequence and die. New ways of activating the gene are being developed.

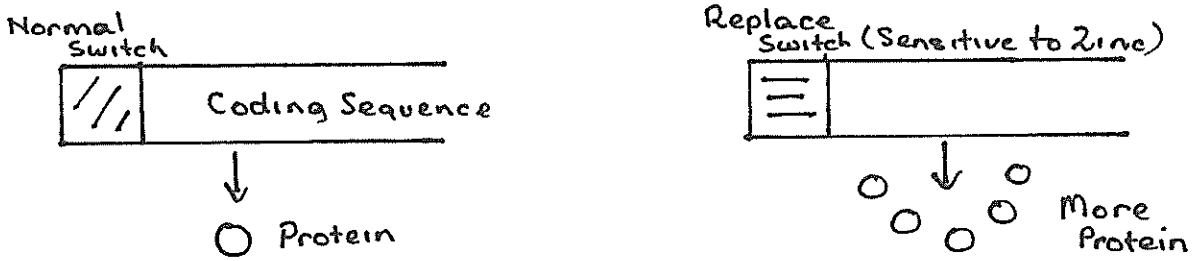


Figure 1: How Gene Works in the Animal

Other uses of genetic engineering are to give sheep the ability to make cysteine, an essential amino acid needed to make wool, by adding an enzyme to its biochemical pathway. The mammary glands of pigs are being used to make the protein responsible for human blood clotting. A plant gene responsible for making chitinase to destroy insect pests, is being put into sheep as a defence against blowfly larvae. Genes can be taken from any plant or animal and put into any animal species!

Dr John Black explained the development of **AUSPIG**, a computer system for the management of a piggery. It takes into account many complex factors and interactions such as strain and sex of pig, amount and composition of feed eaten, climate and penning arrangements, the prices paid for carcases of different weights and quality and the availability of labour, capital and other resources. Managers can have information of the effects any changes in the piggery would have on profitability as well as advice on the best management decisions. Unfortunately, it is too expensive for schools but an excellent system for large commercial operations. Similar programmes could be developed for other livestock, although grazing animals present a problem in knowing their food intake and composition.

Mrs Pat Wilson gave an interesting presentation on **Immunobiology for Animal Production.** We can boost animal production through:

Environment - improving soils and pastures,
The Animal - breeding and genetic engineering, and
Treatments - drenches, growth promotants and vaccines against diseases and **vaccines to regulate hormones involved in reproduction, growth and wool production.**

How do we raise antibodies against hormones? The hormone itself does not stimulate the immune system until it is linked to a larger molecule such as human serum albumen. This large molecule hormone/protein complex is added to an adjuvant (a substance which enhances the immune response) and injected two times to develop antibodies to the hormone (Figure 2). These antibodies block the hormone and inactivate it.

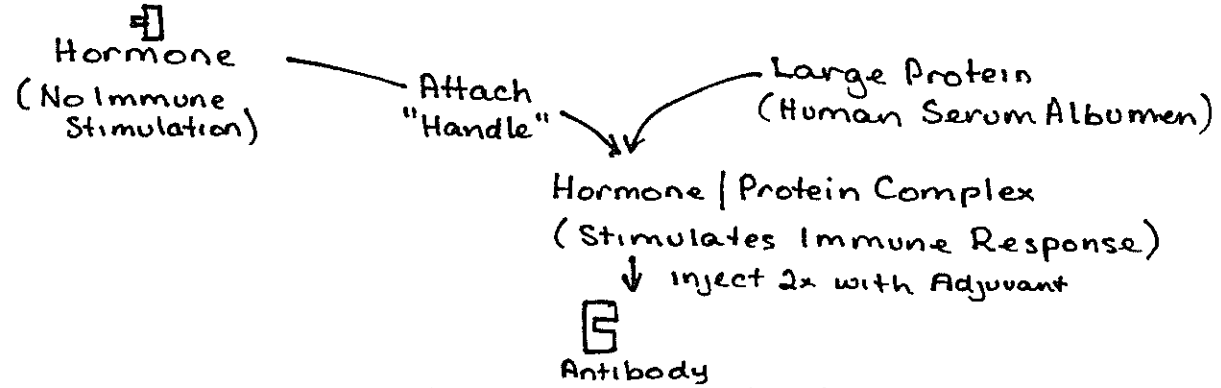


Figure 2: Raising Hormone Antibodies

One example of this is **Fecundin**, used to increase the number of twins in sheep. It develops antibodies against androsteinedione, a hormone produced by the ovary which regulates by feedback the production of gonadotrophin by the pituitary gland. The antibodies bind up some of the hormone and the pituitary responds by producing more gonadotrophin and causing the ovary to develop two follicles instead of one (Figure 3). About 30% of ewes respond and produce twins. They need to be well fed to produce twin lambs.



Normal Ewe Treated Ewe

Figure 3: How Fecundin Works

Fecundin is used in crossbred ewes to increase productivity. Other products have been developed against different hormones for this purpose in Merinos (Multivac) and cattle (Inhibin). Increasing the twinning rate results in increased productivity, faster genetic gain, the need for less breeding stock, allows alteration of the flock structure and the maintaining of production with less animals.

A product called "Vaxtrate" (temporary immunocastration) has been developed to stop pregnancy in cattle. It is a vaccine against LHRH (luteinising hormone releasing hormone) and when injected into cows or heifers prevents pregnancy for the year. It is used in the tropics with cull heifers so they do not become pregnant and fatten better. It also calms males and reduces their libido.

Another hormone target is ACTH which causes the production of cortisol from the adrenal gland. Cortisol, produced in stress, is known to cause a sheep to produce tender wool, put more fat on the carcass and reduce an animal's immunity (Figure 4). By immunising the animal against ACTH, cortisol is reduced and both meat and wool quality are improved. Hormone mimics are being developed to alter an animal's energy balance so it produces more meat and less fat.

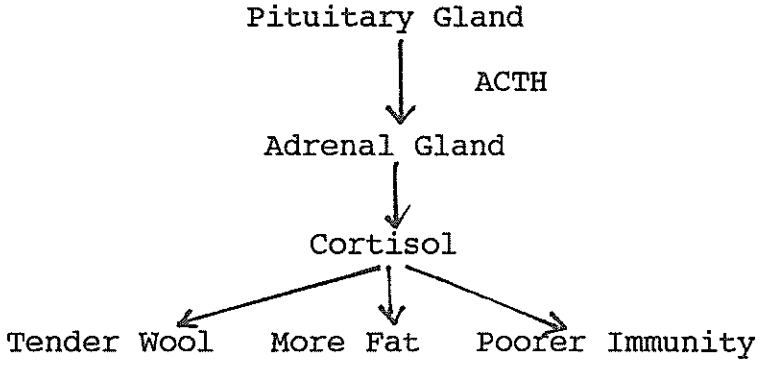


Figure 4 : Effects of Stress

CLASSROOM MANAGEMENT

PART 1

The following are compilation of management strategies employed by teachers of Agriculture, Language and Science, Adele, Rhonda, Jodie, Salim, Michael, John.K John.M, Darshan, Dave, Ian &Elaine Faculties to overcome basic classroom management problems.

PROBLEM	MANAGEMENT STRATEGY
1. Learning the names of students.	* Marking the class roll and having students indicate their presents. * Seating Plans - students seating in same seats for a period of time. Could indicate that roll will be marked on the basis of seating plan. * Name Games (works particularly well with Year 7) * Insist that all books are covered and correctly labelled. * Look for outstanding features of the students. * Concentrating on learning 3 names of students per week.
2. How to get class quiet at the start of a lesson (Gaining their attention).	N.B. Remember all time spent gaining an attentive class is worthwhile as it will result in a better learning environment. * Bring in an item that will gain their attention. * Write the date and heading on the board before the students come into class and get them into the habit of entering the room and writing it down. * Have a procedural start to the lesson that the students are aware of; Coming in orderly, books and pens out, writing up date and heading. OR Lining up and then standing behind seats. * DON'T BE LATE TO CLASS - be there waiting for them where ever possible. Lateness will make them restless. * DON'T START THE LESSON UNTIL EVERYBODY IS READY. * Where necessary whole class detentions to make up for wasted time.

PROBLEM	MANAGEMENT STRATEGY
3. Teaching students to remain seated until asked to do otherwise	* Making sure students know what is expected of them in terms of class behaviour. Make your rules simple and limit the number to the essential ones. (INSIST ON THEIR OBSERVANCE). * Have positive and negative columns on the board (e.g. DETENTION COLUMN - CO-OPERATION COLUMN). * Don't allow borrowing of equipment in class. Keeping a supply of pens, paper and rulers in your desk - so they borrow from you only. * Having to stand all lesson. * Placing students on "self-regulation" behaviour form where they tick the appropriate column when they have performed the desired task. (See Appendix 1). * Use assertive discipline strategies. (See Appendix 2)
4. Interference with the learning of the others.	* Move student to a different part of the room where they can not cause disruption. * Move student to an isolation table or where necessary isolate student into another class. * Implement assertive discipline strategies. (See Appendix 2). * Where applicable use a spatial seating plan for whole class. * Look at your lessons; - Are they exciting. - Are they pitched at the right level. - Is your rooom an exciting learning environment. * Ask for help and discuss the problem - student may have a learning difficulty (e.g. Literacy or N.E.S.B.) * Positive reinforcement (e.g. Merit Certificates).

PROBLEM	MANAGEMENT STRATEGY
	* Negative and positive letters home to parents. * Say something quietly to the disruptive student- try and avoid confrontation, give the student a way out in front of his peers. * Move around your classroom - removes chances for hidden activities. * Show your aggressive side occasionally - it can be very effective (The surprise effect).
5. Failure to follow teacher directives	* Reminders to the students to give them every chance to do the right thing. * Assertive discipline measures (Appendix 2). * Look for a positive in their behaviour pattern and work on it and try and win them around. * Insist on them following your directive. (NAGGING) (GOOD FOR ULCERS). * Let situation diffuse slightly and then try a reason with student. (Make it less confrontational). * Give the instructions clearly and ask if they understand. If necessary ask them if they wish the instruction to be written down. BUT INSIST ON THE INSTRUCTION BEING CARRIED OUT. * Where situation is desperate and student refuses to leave class and there is no help around, leave student in class and move rest of class out. REMEMBER ALWAYS MAKE YOUR INSTRUCTIONS SIMPLE AND CLEAR, KEEP CLASS RULES TO A MINIMUM, INSIST ON THEIR ADHERANCE, TRY THE NON-FRONTATIONAL APPROACH FIRST
6. Non-completion of Assignments and Homework.	* Acknowledging the students who do the right thing - PRAISE, MERIT CERTIFICATES, BONUS MARKS. * Giving students the options e.g. to complete assignment, the consequences of non-completion. * Removal of marks for failure to hand in on time without a satisfactory reason. Make sure that the true worth of the assignment/homework is

PROBLEM	MANAGEMENT STRATEGY
	written down, with the marks deducted for lateness written next to it. Be INSISTANT. * Keep accurate records that can be shown to parents. * Send home form letters to parents. * Always make deadlines for assignments clear, and stick to them. * Indicate to ALL students the assessment strategies that are to be used through out the year. * ALWAYS PLAN YOUR ASSIGNMENTS. Make them meaningful, realistic and interesting.
7. Failure to reach class on time.	* Always make sure you are on time, don't give students any form of physiological advantage. * After they have excused themselves allow them to enter, check up on their reasons later. DON'T SEND THEM OFF FOR NOTES! * Develop roll marking strategy whereby students who are late regularly can be reminded of the fact. * Place them on detentions to make up for lost time.
8. What do we do with students that need to be isolated out of the class	* DON'T PUT THEM OUTSIDE THE ROOM. * THIS SHOULD ONLY HAPPEN AS A LAST RESORT. * Send to Head Teacher with a note of explanation and time. Instant detention for multiple offenders on Monday Afternoon 2.30 - 3.00p.m.

Thanks goes to all those who helped in compiling this document.

IAN SAUNDERS
HEAD TEACHER
AGRICULTURE/LANGUAGE

DAVE BRISON
HEAD TEACHER
SCIENCE.

TELELEARNING

Telelearning is an exciting new computer/communication system which is destined to update Distance Education in N.S.W. and expand the curriculum in all schools.

Telelearning also has particular relevance to teachers and students of Agriculture.

The Telelearning system is in it's final year of trial with two regions - Met. South West and Met West. In the Met West region it involves the schools of Cambridge Park High, Colyton High, Dunheved High and St Marys Senior High. In the Met South West region it involves Leumeah High, Campbelltown High and Sarah Redfern High.

Telelearning involves the use of computer prepared graphics, still frame video pictures, telephone communications and an interactive writing tablet which allows both teachers and students to write messages on either the computer screen or video monitor.

To put it more simply a teacher prepares the lesson before hand by :

* typing into the computer any text that may be important
* using the drawing program to draw any relevant diagrams
* using the video camera to take pictures from books, magazines, or actual objects.

All this information is saved onto the computers hard disk, like the pages of a book. This lesson information can then be sent via the phone lines to one or up to 256 schools, who also have a Telelearning system, and saved on their machines. When the time arrives for the lesson to be taught the teacher rings up the other schools (if more than one receiving school then a conference line needs to be booked with Telecom). The teacher commences the lesson by bringing up the pages which then appear on all the machines. Students are able to communicate with each other and the teacher either orally or by writing on the pen pad which then appears on all the connected systems. Two different screens can be viewed simultaneously, one of which allows video images of a quality better than T.V.

It is a much more interactive and stimulating system than any presently in use.

Telelearning enables a single student at one school or many students at numerous schools to gain access to an expert at an entirely different location. For example you could have Research Scientist at the CSIRO in Sydney give a lesson on In-vitro fertilisation to students at Bourke, Cooma and Girraween. The students would see pictures of the procedure whilst talking with the Scientist.

Presently only still frame video images are possible, but it will soon be able to use moving video pictures.

This system could be of great value to schools who have a few students wishing to study 3 unit Agriculture but not enough to form a class. It could be organised for another school to provide a teacher via Telelearning for the 3 unit electives and possibly with the assistance of a teacher at the home school coordinate the research project. Teachers expertise in different subjects could be shared between schools so that students have a broader range of subject choices. The is particularly important at country schools and smaller metropolitan schools.

Telelearning can also be used as an individual system at a single school. It enables the teacher to prepare innovative lessons which can be stored, revised and reused at a later date. Students can also be involved in constructing the lessons. Presently students at Dunheved have started a simple encyclopedia of Cattle breeds.

I am confident that this system if introduced into NSW schools will greatly benefit all students in particular those attending small schools, disadvantaged schools and those in remote rural areas.

John Killeen

Using Computers in Design and Technology

WORD PROCESSING and DESK TOP PUBLISHING

The word processor is an alternative to traditional writing tools. It has the advantage of being able to add, remove, replace and transfer text on screen. It allows students the opportunity to experiment with and refine work. Desktop publishing software allows students to present work in a professional manner while employing the principles of text and graphic design.

A design brief in the Information and Communications Context may consider the advantages and disadvantages of using wordprocessing and desktop publishing.

Word processing and desktop publishing may be used in any of the Prescribed Contexts to write reports; present design briefs, project outlines, action plans, management plans; record procedures, time lines and activity graphs.

DATABASES

A database is a collection of related data which can be sorted and manipulated. Databases may be used to access information, share information and keep inventories of supplies, resources and equipment.

Databases may be used in all Prescribed Contexts to collect the following data.

- Agriculture
  - to record of projects undertaken e.g. plants grown, results obtained
  - for resource management.
  - to record and manage resources
  - animal husbandry to record stock.

- The Built Environment
  - for graphics libraries of furnishing fabrics, furniture and modular furniture components
  - or properties of materials
  - for anthropometric data related to equipment.

- Clothing and Accessories
  - for fibre and/or material properties and their suitability
  - for maintenance of fabrics.

- Engineered Systems
  - for engineering mechanisms

- Food
  - for food additives and nutrients
  - for recipes
  - for dietary analysis
  - for anthropometric data related to equipment.

- Manufacturing
  - for market research, to collect and manipulate data.
  - to provide insight into consumer desires and attitudes to proposed products.

- Information and Communication
  - for reorganising data and creating output in different forms for discussion about presentation of information and its implications.

- Health and Welfare
  - for a personal diary of diet and exercise
  - for dietary analysis

- Transport and Distribution
  - equipment needed for a camping trip
  - bus and train timetables
  - for barcoding for stock control

- Leisure and Lifestyle
  - for travel and hospitality industries for recording of fitness and performance levels and programs in the fitness industry for CD and video inventories.

SPREADSHEETS

A spreadsheet allows the student to perform complex calculations with data. A student may use data to calculate, simulate and predict budgets with financial data. Calculations may reveal the best of multiple options, e.g. by changing one variable. Decisions can be made about the best alternative in the given situation.

Spreadsheets may be used in all Contexts:

- Agriculture
  - to keep farm accounts
  - to analyse nutrients and feed requirements for animals.

- The Built Environment
  - to analyse of rising costs of space hire in CBD
  - to determine energy costs in different

building designs.

- Clothing and Accessories
  - to calculate costs involved in production of article.

- Engineered Systems
  - to calculate mechanical advantage.

- Food
  - to predict family food costs for a week
  - to compare convenience food costs with home cooking
  - to estimate marketing expenses in producing a new snack food

- Manufacturing
  - to keep account of expenses and profits involved in the product developed
  - to examine mass production costs of a product.

- Information and Communications
  - to simulate electronics calculations
  - to record temperatures and rainfall.

- Health and Welfare
  - to calculate the cost to society of unhealthy lifestyles.

- Transport and Distribution
  - to examine fuel efficiency
  - to estimate costs involved in the distribution of goods
  - to calculate profit margins for wholesalers and retailers.

- Leisure and Lifestyle
  - to examine weight loss programs in relation to cost.

TELECOMMUNICATION

Telecommunications allow data to be transmitted and received over long distances. An example of telecommunications technology involves the use of electronic information service. Information stored in remote computers can be accessed using a computer, a modem and a telephone line. Electronic information services available in Australia include mail, electronic bulletin boards and online databases. The electronic information service used by many schools in NSW is called Keylink.

Telecommunications may be used in all Contexts:

- Agriculture
  - to obtain information on water quality and soil fertility by communicating directly with students who live in affected areas.
  - to access Telecom Discovery Bulletin Board for current prices of agricultural products.

- The Built Environment
  - to access information from students in different built environments to examine the layout of their environment and the ratios of building uses e.g. schools, offices, homes etc.

- Clothing and Accessories
  - to contact students from different climates and cultures for first hand knowledge of clothing.

- Engineered Systems
  - to conduct market research using Keylink.
  - to access graphics via modems.

- Food
  - to contact students from different cultures and areas to survey dietary habits, e.g. Torres Strait Islanders.

- Manufacturing
  - to access graphics via modems.

- Information and Communications
  - to download images and analyse for weather patterns from a weather satellite.

- Health and Welfare
  - to contact students from different cultures and environments to survey lifestyle factors contributing to diseases or disabilities e.g. pollution and sun exposure.

- Transport and Distribution
  - to determine how transport and distribution companies link their depots.

- Leisure and Lifestyle
  - to contact students from different cultures and areas to survey leisure and lifestyle habits.

COMPUTER GRAPHICS

Graphics software enables students to produce visual images by manipulating shapes, lines, scale, texture and colour.

The following types of programs may be used in all Contexts:

- paint

- draw
- CAD (Computer Aided Design)
- animation
- graphing and charting
- video
- scanning and digitising

Computer Graphics may be used in all Contexts:

- Agriculture
  - for crop rotation, farm layouts
  - for stockyard layout and animal movements races.

- The Built Environment
  - for 2D and 3D drawings
  - for building designs
  - for building designs
  - for interior layouts
  - for templates and patterns for construction

- Clothing and Accessories
  - for templates and patterns for construction
  - for 2D and 3D drawings and perspectives for surface decoration designs

- Engineered Systems
  - for structural drawing and design

- Food
  - for packaging for new food in the school canteen

- Information and Communications
  - for company logo using a draw or paint package.
  - for an advertisement poster for your company or product
  - for graphics, paint and animations, transfer to video for a school based TV station.
  - for a video, using live footage, graphics, animations and titling, to present the Design and Technology course, or the school to prospective students and parents.

- Health and Welfare
  - for animation which simulates a physical condition (e.g. lung capacity, heartbeat).
  - to demonstrate how a device will monitor the condition
  - for an exercise aid to enhance the fitness of the user.

- Leisure and Lifestyle
  - for logos for sporting goods
  - to graph fitness test results
  - for human movement programs
  - for brochures for the leisure industry
  - for personal stationery.

- Manufacturing
  - for a device for recycling or reusing waste.

- Transport and Distribution
  - for ticket design
  - for signwriting

CONTROL SYSTEMS

Control Systems control many of the electronic and mechanical machines and devices used in society, eg traffic lights, microwave ovens, manufacturing production lines. Control Systems allow students to govern the power of a functional part of a mechanism.

Control Systems may be used to govern mechanisms within all Contexts:

- Agriculture
  - for water flow devices

- The Built Environment
  - for air conditioning control systems
  - for security system using light sensors

- Clothing and Accessories
  - for robotics for a clothing manufacturer

- Engineered Systems
  - or a robotic system to perform specific tasks
  - for C & C lathe functions

- Food
  - for techniques to mass produce food stuffs
  - for robotics for a bakery
  - for the working of a microwave oven

- Manufacturing
  - for principles of numerical control
  - for machinery programming a C & C lathe.

- Information and Communications
  - for video surveillance
  - for warehouse and factories' use of remote accessing

- Health and Welfare
  - for a monitoring device for a physical condition, e.g. lung capacity, heartbeat
  - for hospital.

- Transport and Distribution
  - for traffic control systems
  - for intelligence applications
  - for the distribution of goods

Using Computers in Design and Technology

- Leisure and Lifestyle
  - for pool safety systems
  - for VCR programming
  - for intercom systems

SIMULATIONS

Simulations allow students to experience and make decisions about real world situations without leaving the classroom. Problem solving scenarios and examination of content is possible.

Computer simulations may be used in all Context areas:

- Agriculture
  - to make decisions about land use, and the consequences of change.
- The Built Environment
  - to make decisions urban planning and to examine the environmental and sociological implications.
- Clothing and Accessories
- Engineered Systems
  - to make decisions about structural design and examine environmental implications.
- Food
  - to make decisions on food production and examine the implications of altered food supplies
- Manufacturing
  - for CAD/CAM
- Information and Communications
  - for provision of public services, e.g. ambulance and police.
- Health and Welfare
  - to make decisions and examine the implications of altered services
- Transport and Distribution
  - to make decisions about the implications and examine the implications of those
  - to make decisions for transport and distribution of goods and services.
- Leisure and Lifestyle
  - to make decisions about urban planning of a city and experience the consequences of those decisions for lifestyle and leisure activities.

(notes from the Draft Design and Technology Years 7-10 Support Materials)

NB: This is only a draft form - it could still go through many changes!

NITROGERM - -



-- it keeps cropping up !

The inoculant for bigger, healthier legume growth.

ADVANCE AGRICULTURE

A.I.R.C.S. APPROVED 1991 EDITION

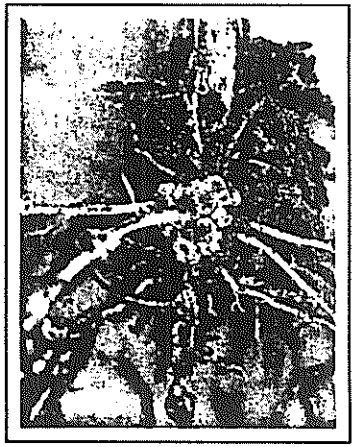
Introduction

All plants, legume and non-legume, require the element nitrogen to form the green pigment chlorophyll and to manufacture proteins and other complex organic compounds within the plant. Non-legumes, such as grasses, depend on available nitrogen in the soil. Australian soil is innately deficient in nitrogen and in the absence of adequate nitrogen supplies, plants remain stunted, unthrifty and undeveloped.

The application of nitrogenous fertilisers is costly and the more economic approach to soil fertility management is to incorporate legume crops. Legumes, such as lucerne, clovers, peas or lupins, when effectively nodulated by the root-nodule bacterium *Rhizobium*, utilise nitrogen in the air. Legume nodules contain millions of microscopic bacteria (rhizobia) which convert nitrogen from the air into a form available to the plant. This process is known as **nitrogen-fixation**.

There are numerous species and hundreds of strains of *Rhizobium* which can differ in the types of legumes they nodulate and in the efficiency they fix atmospheric nitrogen. Effective nodules contain strains of Rhizobium which are highly "efficient" converters of atmospheric nitrogen with their specific host plant and are characterised usually by being few in number, large, situated near the crown of the plant and pink inside when young. Ineffective nodules are usually small and numerous, located over the entire root system and are commonly white.

Not many soils contain sufficient effective root-nodule bacteria strains necessary to promote maximum growth of legumes. In order to ensure that effective nodulation will occur when cropping legumes it is recommended to add (inoculate) large numbers of effective strains of *Rhizobium* to the seed or to the sowing furrow when planting. This ensures that the correct strain of *Rhizobium* is in close proximity to the roots of the germinating seedling and thus in a position to cause effective nodulation.



Lupin plant root effectively nodulated by NITROGERM Legume Inoculant Group G.

The legume/bacteria symbiotic association requires the nutrients molybdenum, cobalt and sulphur to convert the free nitrogen from the air into a form the plant can use. Molybdenum and cobalt are needed in much greater supply for nitrogen fixation than for plant growth. The addition of 50 grams per hectare of molybdenum is recommended when sowing pasture legumes. Molybdenum may be safely added to the inoculated seed by using molybdenum trioxide, ammonium molybdate or introduced separately from the seed as Mo-Superphosphate fertiliser. Do NOT expose *Rhizobium* to sodium molybdate as it is toxic!

NITROGERM legume inoculants are high quality cultures of specific strains of root-nodule bacteria. Some 30 different NITROGERM Group types are currently produced for the increasing variety of legume crops grown in Australia (see inside listing). NITROGERM cultures are under constant testing and are guaranteed to be one of the highest quality legume inoculants in the world today.

Inoculation Methods

Proper inoculation may mean the difference between success or failure of a legume crop, especially when growing legumes for the first time in a soil. The ultimate aim of inoculation is to get as many viable nitrogen-fixing bacterial cells in the inoculum on and around the seed root when germinaton occurs. This helps guarantee the nodule formation and occupancy is from the inoculum and not from indigenous soil rhizobial populations which may be made up of moderately-high ineffective *Rhizobium*. The correct use of NITROGERM legume inoculants ensures that a highly effective strain of rhizobia for the particular legume being sown will be present in the vicinity of the young seed root radicle. This acts as a very economical insurance against the possibility that efficient strains of *Rhizobium* are not present in the soil.
Full instructions for inoculating seed with NITROGERM cultures are clearly printed on each packet. The following is a general summary of inoculation techniques. Current methods of inoculating legume crops are either by seed inoculation via slurry, lime pelleting or by liquid inoculation. Check with your State Agriculture Department for any specific inoculation recommendations. Inoculation techniques are as follows:

Slurry: Seed treated with a water solution containing water, adhesive and inoculant.
This slurry mixture is poured or sprayed over the correct weight of seed and can be mixed thoroughly by using a concrete mixer or a revolving drum. Seeds should be inoculated immediately prior to sowing. This is essential as the death rate of rhizobia on uncoated seed is rapid. Adhesion of the inoculant to the seed is improved by using a 0.5% methycellulose solution instead of just water. The adhesive provides some protection for the bacteria from the harmful effects of high temperature and the drying associated with storage and dry sowing. The maximum storage period for slurry inoculated seed before sowing is **24 hours**. If after inoculation the seed is not sown within this time it **must be re-inoculated**.

Lime Pelleting: Seed pre-treated with a solution containing water, adhesive and inoculant with a final coating of fine lime.
Pasture legumes are usually inoculated by lime pelleting. The adhesive methycellulose is currently recommended and a 1.5% - 2% solution is advised. The correct amount of lime (12.5 Kg per Standard NITROGERM pack) is added all at once after inoculation with the adhesive/ inoculant solution. The seeds are mixed until all are evenly coated and the pellet has been formed. The lime must be a finely ground calcium carbonate that will pass at least a 300 mesh sieve. Agricultural lime and builders lime are **not** suitable. Lime pelleting is a precise procedure and a small experimental batch is advised when attempting this form of inoculation for the first time. The pellet may be stabilised with a very small application of a 1/10th normal strength adhesive solution used for inoculation lightly sprayed after pelleting and while the seeds are still rotating.
Lime pelleting seed counteracts soil and/or fertiliser acidity around the seed which improves survival of rhizobia. Incorporation of the inoculum within the pellet also ensures better survival of the bacteria when delays between inoculation and sowing are unavoidable. Lime pelleted seed may be stored at a cool room temperature for **one week.**

Liquid Inoculation: A NITROGERM peat culture mixed with water to make a liquid inoculant which can be sprayed or dribbled directly into the seedbed at the time of sowing.
When the seed germinates, its roots pass through a band of inoculated soil, leading to formation of nodules. Introducing rhizobia into soil separately from the seed is the best method when the seed itself has been treated with insecticides or fungicides, most of which are harmful to rhizobia. This method is also a successful alternative when sowing large areas of grain legumes.
The liquid inocula is made by mixing an amount of appropriate peat inoculant corresponding with the normal rate of seed inoculant into a paste with water. This is diluted to a slurry and filtered through fine muslin, cheese cloth or nylon stocking before adding to the tractor-mounted water tank. A low volume application of 112 litres/Ha is enough for spray inoculation. A higher rate is undesirable because of the increased water load, more frequent refilling stops required and because it can lead to premature seed germination. Always check capillary outlets or nozzles for flow before starting each run. See the N.S.W. Department of Agriculture Agfact P4.1.2., 1982, entitled *"Spray Inoculating Grain Legumes"* for details of setting up such a

Precautions

1. Cultures should be stored in a cool place (ideally 4°C Temp., **do not freeze**) whenever possible except for inoculants for *Centrosema, Lablab, Desmodium,* and Oxley Stylo which should be stored near 20-25°C.

2. Cultures should be used before the expiry date shown on the packet.

3. Do not store part of an opened packet as it may deteriorate through contamination. Over-inoculation is **not** harmful.

4. Direct sunlight must be avoided on the culture and during inoculation and drying of the seed. Inoculated seed will rapidly lose its inoculum viability if left in the sun.

5. Use rainwater with inoculum whenever possible as chlorinated water can be harmful. Do not use water or equipment contaminated with chemicals likely to be harmful to bacteria, e.g. detergents, fungicides, insecticides, fertilisers (except lime or dolomite). Superphosphate should **not** be mixed with uncoated inoculated seed as the acidity of the fertiliser will kill the bacteria. Lime pelleted seed can be in contact with superphosphate for a short time without dramatic loss of inoculum. Do not mix inoculum with: **A.** insecticides containing dimethoate, omethoate, endosulfan, carbofuran or aldicarb. **B.** fungicides containing iprodione (Rovral®) or captan. **C.** herbicides such as MCPA, 2,4-d, Dinoseb®. **D.** chemicals containing high levels of mercury, copper or zinc. **E.** sodium molybdate fertiliser.

Summary

Inoculation is not a cure-all. It does not replace the need for adequate amounts of superphosphate and lime, nor does it replace the necessity for other good soil management practices. But by increasing the nitrogen inputs, inoculation plays an important role in soil improvement and farm income. It is worth the effort to make sure the *Rhizobium* inoculum reach the field **alive.** Take all precautions as NITROGERM root-nodule bacteria are sensitive live organisms having virtually no natural defenses against harsh conditions.

Manufactured by:
BIO-CARE TECHNOLOGY PTY. LTD.
84 Rawson Road, WOY WOY, NSW 2256.
Ph: (043) 42 2533 Fax: (043)43 2083

Your NITROGERM Supplier:-

I (ORANGE CODE)	*Vigna unguiculata*	Cowpea	Red Caloona, Poona, Caloona, Alumba, Maringa, Brandon, Arafura,Mulgrave, Pyramid, Banjo (Black-eyed Pea) etc.	100	-
	V.angularis	Adzuki Bean		100	-
	V.radiata	Mung Bean or Green Gram	Regur, Berken, Celera, King, Satin, Shantung, Putland	100	-
	V.mungo	Mung Bean or Black Gram Urd Bean, Mash, Black Matpe		100	-
	Others:*Vigna trilobata, V.marina (Dune Bean), V.vexillata, V.unguiculata ssp.,sesquipedalus (Asparagus or Snake Bean), V.parkeri (Creeping vigna, c.v.Shaw). V.umbellata (Rice Bean), V.aconitifolia (Moth Bean) etc.*				
J (PURPLE CODE)	*Cajanus cajan*	Pigeon Pea	Hunt, Quantum, Royes, Quest	100	-
	Lablab purpureus	Dolichos lablab, Hyacinth Bean	Highworth, Rongai	100	-
	Macrotyloma unifforum	Horse Gram	Leichardt	50	-
	M.axillare	Perennial Horse Gram	Archer	50	-
K (LIGHT BLUE CODE)	*Trifolium semipilosum*	Kenya White Clover	Safari	25	-
L (LIME GREEN CODE)	*Lotononis bainesii*	Lotononis	Miles	10	-
M (BROWN CODE)	*Mucuna deeringianum*	Velvet Bean, Banana Bean		100	-
	Macroptilium atropurpureus	Siratro		50	-
	M.lathyroides	Phasey Bean	Murray	50	-
	Pueraria phaseoloides	Puero, Tropical Kudzu		50	-
	Calopogonium mucunoides	Calopo		50	-
	Neontonia wightii	Glycine	Tinaroo, Clarence, Cooper, Malawi	25	-
	Others:*Pueraria lobata (Kudzu), Clitoria ternatea (Butterfly Pea), Crotalaria spp (Gambia Pea), Colgania spp., Atylosia sericea, Canavalia ensiformis, (Jack Bean),Cassia rotundifolia (Wynn Cassia), Flemingia congesta, Galactia striata, Indigofera spp., Lespedeza spp., Teramnus spp., Rhynchosia minima, Tephrosia candida, Psophocarpus tetragonolobus (Winged or Goa Bean) , P. palustria etc.*				
N (GOLD CODE)	*Cicer arietinum*	Desi Chickpeas	Tyson, Amethyst, Dooen, Barwon, Semsen etc.	100	250
		Garbanzo or Kabuli Chickpeas	Opal, Garnet, Macareena, Narayen, Kaniva etc.	100	250
O	*Trifolium resupinatum*	Persian or Shaftal Clover	Maral, Kyambro	25	-
P	*Arachis hypogaea*	Peanut or Groundnut		100	-
S	*Stylosanthes guianensis var guianensis*	Fine Stem Stylo	Oxley	25	-
	S.guianensis var intermedia	Stylo	Cook, Endeavour, Schofield, Graham	25	-
	S.humilis	Townsville Stylo	Paterson, Lawson, Gordon	25	-
	S.scabra	Shrubby Stylo	Fitzroy, Seca	25	-
	S.viscosa			25	-
	S.fruticosa			25	-
	S.erecta			25	-
		SPECIAL INOCULA			
SU303	*Vicia faba*	Faba, Tick, Horse or Broad Bean	Fiord (Faba bean), Aquadulce (Broad Bean)	100	250
WSM540	*Medicago murex*	Murex	Zodiac	50	-
CB1923	*Centrosema pubescens*	Centro	Belalto	100	-
	C.pascuorum	Centurion	Cavalcade, Bundey	100	-
CB627	*Desmodium intortum*	Desmodium	Greenleaf	25	-
	D.uncinatum		Silverleaf	25	-
CB2085	*Desmodium.heterophyllum*		Johnstone, Hetero	25	-
CB3060	*Leucaena leucocephala*		Peru, Cunningham	100	-
CB1650	*Stylosanthes hamata*	Caribbean Stylo	Verano, Amiga	25	-
CC1500 & CC1501	*Chamaecytisus palmensis*	Tree Lucerne or Tagasaste		10 or 50	-
CB2312	*Aeschynomene americana var glandulosa*	Joint Vetch	Glenn	50	-
	A.falcata		Bargoo	50	-
CC1099	*Onobrychis viciifolia*	Sainfoin	Othello	50	-
QA1085 (=CB3035)	*Cyamopsis tetragonoloba*	Guar or Cluster Bean		100	-
NA722	*Arachis pintoi*	Pinto's peanut	Amarillo	100	-
SU343	*Lotus comiculatus*	Birdsfoot Trefoil	Leo, Upstart	10	-
SU277	*Trigonella foenum-graecum*	Fenugreek		50	-

Benefits:

Farmers now recognise that under a legume-based rotation system soil fertility improves considerably, resulting in higher stock carrying capacity and crop yields. Wheat yields after a lupin crop are commonly higher (130% reported) than from a wheat-wheat cropping system. Three major benefits validated when growing legumes in rotation with cereals are:

1. Chemical improvement of the soil through nitrogen-fixation.
2. Improved physical soil structure.
3. A break in the life cycle of winter cereal diseases such as yellow leaf spot.

The amount of nitrogen fixed by legumes varies widely with host genotype, *Rhizobium* efficiency, soil and climatic conditions. Estimates range from 50-300 Kg N/Ha/year (equivalent to 108-652 Kg of Urea or 238-1428 Kg of Sulphate of Ammonia).

LEGUME CROP INOCULATION GROUPS

The various groups of legumes each have their own specialised rhizobia, and must therefore be given the right strain for successful nodulation and maximum nitrogen-fixation. Different strains of NITROGERM are available for the following groups of legumes (the figures indicate the weight of seed a Standard Pack or Large Pack will inoculate).

Inoculant Group Type	HOST PLANT			Weight Of Seed Treated (Kg).	
	Botanical Name	Common Name	Cultivar Examples	Std	Lge
A (RED CODE)	*Medicago sativa*	Lucerne or Alfalfa	CUF101, Siriver, Hunterfield, WL Southern Special, WL514, WL318, WL451, Pioneer 545, Siro Peruvian, Sheffield, Springfield, Nova, Condura 73, Matador, Wakefield, Sequel, Baron, Sirotasman, Demnat, Paravivo, Walkabout, Aurora, Diamond, Validor, Granada, Trifecta, Quadrelia etc.	25	-
	M.littoralis	Strand Medic	Harbinger AR	50	-
A (RED CODE)	*M.truncatula*	Barrel Medic	Cyprus, Cyfield, Jemalong, Sephi, Paraggio, Ascot, Akbar, Ghor, Borung, Hannaford, Parabinga etc.	50	-
	M.polymorpha	Burr Medic	Circle Valley, Serena, Santiago	50	-
	M.scutellata	Snail Medic	Robinson, Sair, Sava, Kelson	50	-
	M.tomata	Disc Medic	Murrayland, Tornafield, Swani, Rivoli	50	-
	M.rugosa	Gama Medic	Paragosa, Paraponto, Sapo	50	-
B (YELLOW CODE)	*Trifolium repens*	White Clover	Ladino, Haifa, Siral, Irrigation, Grasslands Pitau, Tamar, Grasslands Huia, Grasslands Tahora, Grasslands Kopu, Louisiana S1.	25	-
	T.pratense	Red Clover	Redquin, Redwest, Grasslands Hamua, Montgomery Red, Grasslands Pawera, Grasslands Turoa	25	-
	T.fragiferum	Strawberry Clover	Palestine, O'Connor, Shearmans	25	-
	T.hybridum	Alsike Clover		25	-
	T.purpureum	Purple Clover	Paratta	25	-
	T.alexandrinum	Berseem, Egyptian Clover	Bigbee, Carmel	25	-
	T.glomeratum	Cluster or Ball Clover		25	-
	T.dubium	Suckling Clover		25	-
	T. vesiculosum	Arrowleaf Clover		25	-
C (PINK CODE)	*Trifolium subterraneum*	Sub Clover	Mount Barker, Junee, Nungarin,Seaton Park, Daliak, Enfield, Northam, Woogenellup, Dalkeith, Karridale, Bacchus Marsh, Dinninup, Esperance, Geraldton, Tallarook etc	50	-
	T.yanninicum	Sub Clover	Trikkala, Larisa, Meteora, Yarloop	50	-
	T.brachycalycinum	Sub Clover	Clare, Rosedale	50	-
	T.incarnatum	Crimson Clover	Dixie	50	-
	T.cherleri	Cupped Clover	Yamina, Beenong, Lisare etc	50	-
	T.hirtum	Rose Clover	Kondinin, Sirint, Olympus, Hykon	50	-
	T.balansae	Balansa Clover	Paradana	25	-
D (OLIVE GREEN CODE)	*Lotus pedunculatus*	Lotus	Maku	10	-
E (DARK GREEN CODE)	*Pisum sativum*	Pea	Snow Peas, Snap Peas, Princess, Massey, Greenfeast, Victory Freezer, Bikini Snow Peas, etc.	100	250
	P.sativum	Field Pea	Dun, Dundale, Maple, Collegian, Derrimut, Buckley, Cressey Blue, Maitland, Rondo, White Brunswick, Blue Prussian, Wirrega, Alma, Progreta, Whero, Pennant, Dinkum etc.	100	250
	Vicia sativa	Common Vetch or Tare	Golden Tares, Languedoc, Nyabing, Blanchefleur etc	100	250
	V.dasycarpa	Woolly Pod Vetch	Namoi	100	250
	V.benghalensis	Purple Vetch	Popany	100	250
	Lens culinaris	Lentil	Laird, Io, Callisto, Kye	100	-
	Lathyrus sativus	Grass Pea		100	-
	L.odoratus L.	Sweet Pea		100	-
F (MUSTARD CODE)	*Phaseolus vulgaris*	French or Common Bean (Fresh)	Redlands Autumncrop, Spartan, Arrow, Redlands Pioneer, Redlands Wintercrop, Hawkesbury Wonder,. Tweed Wonder, Windsor Longpod, St Andrew, College Pride, College Early, Brown Beauty, Wellington Wonder, Belle, Spartan etc	100	-
		(Processing)	Apollo, Burnley, Conquest, Canyon, Cascade, Idachief, Idelight, Jackpot, Orbit, Tendergreen, Gallatin 50, Valgold, Blue Lake, Tendercrop etc.	100	-
		Navy, Kidney, Dry or Pinto Beans	Borlotto, Cannellino, Charrlevoix, Galleroy, Red *Mexican* Regal Rouge, Sanilac, Seafarer, Seaway, Manitou, Perry Marrow, Redkote, Actolac, Kerman etc.	100	-
	P.lunatus	Lima Bean, Butter Bean	Fordhook, Thorogreen etc.	100	-
	P.coccineus	Scarlet Runner Bean, Fire Bean		100	-
G (DARK BLUE CODE)	*Lupinus angustifolius*	Narrow Leaf Lupin	Uniwhite, Uniharvest, Unicrop,Marri, Illyarrie, Yandee, Danja, Geebung, Blanco, Myrzynek, Borre, Fest, NZ Blue, Beliak, Gungurru, Yorrel etc.	100	250
	L.albus	Mediterranean White Lupin	Ultra, Hamburg, Kiev Mutant etc.	100	250
	L.luteus	Yellow Lupin	Weiko 111	100	250
	L.cosentini	Sandplain Lupin	Chapman, Eregulla etc.	100	250
	Ornithopus compressus	Yellow Serradella	Pitman, Uniserra, Tauro, Avila, Elgara (Berber), Eneabba, Madeira, Paros etc.	50	-
	O.pinnatus	Slender Serradella	Jebala	50	-
	O.sativus	French Serradella	Koha	50	-
H (SILVER CODE)	*Glycine max*	Soybean	Chaffey, Bowyer, Farrer, Ridley, Valder, Calland, Bragg, Davis, Centaur, Dragon, Forrest, Dodds, Reynolds, Dickie, Bossier, Fitzroy, Nautilus, Southee, Victor, Stephens, Asgrow A5939, Manark, Lachlan, Carroll, Alabaster, Dune etc.	100	250

Programmed Learning Exercise

NITROGEN FIXATION BY LEGUMES

Notes for students. The idea behind this method of learning is that you will get short pieces of information. You will then be asked some questions about what you have just read. You will be asked to check your answers on the following page. The exercise is not a race, so work at your own speed.

SIMPLE RULES TO FOLLOW WHEN COMPLETING THIS EXERCISE

1. Where you are given a choice of answers simply cross out those which are wrong.
2. Where there is a blank space fill in the missing word or words.
3. Do not turn the page until you have answered all the questions and you are satisfied that they are correct.
4. If you happen to make a mistake, re-read the information, but do not proceed until you understand where you went wrong. If necessary ask your teacher for assistance.

Remember: Only people who dont do anything never make a mistake!

The aim of this cource is to have you comprehend the way in which certain plants and bacteria act together to produce nitrogen for themselves and other plants too.

SYMBIOTIC NITROGEN FIXATION

There are three main factors limiting pasture production in Australia. These are deficiencies of water, nitrogen and phosphorus. Apart from the the carbon-based material in the ground derive from photosynthesis, the most common element is nitrogen. The main plant and animal substances containing nitrogen are amino acids, the sub units of proteins. There are other compounds containing nitrogen, not the least important being the nucleic acids, the compounds responsible for genetic inheritance.

Apart from the legumes, the common pasture plants can only obtain their nitrogen from the soil and then only as nitrate (NO_3^-) or ammonium (NH_4^+). The principle means of building up soil nitrogen is through the symbiotic association between the legume and the nodule bacteria, Rhizobium species.

Symbiosis = inter dependant relationship of mutual benefit.
i.e. two organisms living together for their mutual benefit

The importance of this symbiotic association will be examined along with the biological and soil environmental factors influencing the association. Ways and means of promoting nodulation will also be studied.

1. The three factors limiting pasture production in Australia are deficiencies of -----
---------- , ---------- and
----------.

2. Nitrogen is a major constituent of ----------

3. The principle means of building up soil nitrogen is
   i) Through the use of organic fertilisers
   ii) Through the symbiotic association between the legume and Rhizobium bacteria.
   iii) Through the use of inorganic fertilisers.

4. Plants take up nitrogen in the form of ---------- and
   ----------.

Answers

1. Water. nitrogenø phosphorus
2. Protein
3. ii
4. Nitrate and ammonium

IMPORTANCE OF ROOT NODULES ON LEGUME PLANTS

The value of legumes has been recognised in agriculture from the earliest civilisations; legumes featured in the cropping systems of the earliest Egyptian dynasties and Roman writers stressed their importance in the improvement of soils. It was not until the late 19th century that it was realised that the conversion of nitrogen of the atmosphere to plant food takes place in small outgrowths called NODULES which appear on the roots of leguminous plants. These develop only in response to the invasion of the roots by soil bacteria of the genus RHIZOBIUM, which are able to live in a state of symbiosis with the plant as well as freely in the soil like other bacteria. It is the bacteria in the function nodules which are able to "fix" atmospheric nitrogen into the forms which are able to enter the translocation system of the plant.

In circumstances where the root nodules are absent or ineffective, legumes may deplete reserves of soil nitrogen faster than do cereals and grasses, as they use more nitrogen. The plant provides a source of carbohydrate for the RHIZOBIA bacteria; the bacteria providing nitrogenous compounds for the plant in return.

1. Name four leguminous crops. ---------- ---------- ---------- ----------

2. Where does the conversion of atmospheric nitrogen to nitrate and ammonium take place in leguminous plants?

3. To what genus do the bacteria which convert atmospheric nitrogen belong?

4. What is the difference between the terms "nitrogen fixation" and "phosphorus fixation". If you have not studied phosphorus and its fate in the soil, you may need the help of you teacher with this question.

Answers

1) Clovers, beans, chickpeas, lucerne, soybeans and there are many others.
2) In the root nodules.
3) Rhizobium
4) Nitrogen fixation puts nitrogen from the air in a form that plants can use. With phosphorus fixation, phosphorus is held by the soil in a form that plants cannot get straight away.

CHEMISTRY OF THE PROCESS

Photosynthesis occurs in the leaves. The sugars and carbohydrates made by this process are transported throughout the plant and supply the energy food source for respiration of plant cells.

In the root nodules, complex chemical reactions occur. The major chemical reaction occurring is the reduction of nitrogen gas (N_2) to ammonia (NH_3) by rhizobium bacteria.

Nitrogen $\xrightarrow[\text{Rhizobium bacteria}]{\text{Enzymes}}$ Ammonia

This is made possible by the energy released from carbohydrates (sugars). As a food source for the bacteria the carbohydrates yield energy and in turn are oxidised to carbon dioxide (CO_2).

The legume plant through its symbiotic relationship with the rhizobia bacteria possesses an efficient mechanism for converting nitrogen gas from the soil air to ammonia inside the plant root. Once ammonia (NH_3) is available, it can be fixed by the plant into organic compounds such as amino acids and proteins. Carbon dioxide is also used in these reactions. Healthy legume plants therefore do not depend on the supply of soil nitrate or ammonium nutrients for their nitrogen requirements.

1. Legume plants obtain ---------- from bacteria and bacteria obtain ---------- from the plants.
2. Why would "fixation" be impossible in waterlogged soils? ----------
---
3. Generally, what type of soils, heavy or light, would be best suited for ammonia production by Rhizobium bacteria.

Answers

1). Ammonia Sugars or carbohydrates
2) There would not be any air, therefore there would be no nitrogen.
3) Light

FIELD TESTING FOR EFFECTIVE NODULATION

Functioning nitrogen-fixing nodule tissue is pink in colour; non-funtioning tissue is green. Nodules with effective strains of Rhizobium funcion longer than those with poor strains, with the result that the proportion of nodules with pink cross sections is high on effectively nodulated roots. The pink pigment, leghaemoglobin, is associated with the nitrogen fixing nodule tissue. When the tissue breaks down, free Rhizobium bacteria convert the leghaemoglobin to green, bile-like pigments.

1). Funtioning nodule tissue is pink, or green.

2). Examine your specimen again. Is it effectively nodulated?

Obtain more specimens, either at home or from school and compare these. If you are able to find a piece of ground where one type of legme is effectively nodulated, search for another species and find out if it is also aeffectively nodulated. If it is not can you suggest a reason why?

1) Pink
2) Check the answer with your teacher.

FACTORS AFFECTING NODULE DEVELOPMENT

1. NUTRITION AND GROWTH

Nodule development and activity can be affected by mineral nutrition and by conditions of growth of the host plant.

Calcium and phosphorus play an important part in the Rhizobium nodule relationship. Phosphorus helps to maintain the population of nodule bacteria in the soil at a high level. This element also stimulates the mobility of the bacteria so they can move through the soil easily to the roots.

Calcium is important for the nutrition of the legume and the bacteria. When there is insufficient calcium in the soil, the bacteria are thought to change into an inactive form, unable to invade the plant. The addition of lime to the soil also improves nodulation, owing both to the calcium added in the lime and the resulting increase in pH. Both these conditions are required for effective nodulation of legumes in acid soils. On very acid soils lime is needed to induce the formation of nodules. Without nodules the legume cannot fix nitrogen and therefore cannot grow normally even when treated with phosphorus and molybdenum, a trace element which is essential in the fixation process and one which is sometimes lacking in more acid soils. Rhizobia are very much restricted in soils with a pH level of below 5.

1). What mineral deficiencies may impede nodule development? ----------
-------- ---------------
----

2). At what pH level does Rhizobia activity become restricted? ------------
----

3). If your soil was acidic, how would you go about raising the pH? --------
----

1) Phosphorus, calcium and molybdenum.
2) 5
3) Add lime

FACTORS AFFECTING NODULE DEVELOPMENT. CONTD.
2. ENVIRONMENTAL FACTORS

*Temperature. Rates of nodule development are restricted at soil temperatures below 18°C with such restrictions being quite severe below 10 °C and nodules failing to form at all below 8°C. It is therefore very important that any autumn sowings be made early enough for nodule development fo be well advanced before the onset of very cold weather as unnodulated clovers rarely survive a cold winter unless soil nitrogen levels are high. The upper limit is 30 °C.

Apart from nodule formation, nitrigen fixation is retarded by low soil temperatures even on well nodulated plants. However, all plant growth is retarded under these conditions and this seems to balance out.

*Microbial Competition. The main problem with this competition comes from other nodule bacteria, especially those able to nodulate the same host plants as the most effective species for that legume. This can be a severe problem in areas where the native strains are relatively ineffective in their nodulation of the introduced legume. There are two ways around this problem 1) high inoculation rates and 2) more virulent strains of bacteria in inoculants that outgrow and successfully compete for nodulation sites.

1) What are the two main environmental factors referred to on this page? ----- ---------- ----------

2) What is the range of temperatures within which nodulation can take place. --- ----------

3) What seasons are best to avoid when sowing legumes in cold climates. ------ ----------

4) Microbial competition from ineffective nodule bacteria can be a serious problem. True or false?

1) Temperature Microbial competition
2) 8 C- 30 C
3) Late autumn, winter
4) True

INOCULATING LEGUME SEEDS

Not all soils contain the bacteria necessary to promote the growth of legumes. They are mostly absent in virgin and acid soils which do not freely support growth of clovers, lucerne, trefoils or other legumes. When growing legumes on soils of this nature, it is desirable to supply rhizobium bacteria of the appropriate strain. Absence of the right kind of bacteria may lead to stunting in the growth of the legumes which often look yellow and are spindly (nitrogen deficiency symptoms).

Cultures of highly effective bacteria are available. The most economical and simple way to safeguard against failure is to inoculate the seed before sowing on new land or where a similar legume has not been grown before. When sowing on acid soils, inoculated lime or coated seed should be used. The same strain of Rhizobia bacteria will not noduale every species of the legume family. A number of groups of legumes have been found, each of which requires a separate and distinct strain of nodule bacteria for inoculation. The groups are as follows:

Group	
	1. All species of Medicago and Melilotus
	2. All species of Trifolium
	3. Garden pea,field pea,sweet pea,vetches,tares
	4. Cow peas, Japanese clovers
	5. All true beans
	6. NZ and WA blue lupins, yellow lupins
	7. Soybeans

1) Rhizobium baceria are mostly absent from ----------and --------
----------soils.

2) What are the common symptoms of nitrogen deficiency? 1.----------
---- 2.---------- 3.----------

3) All species of legumes can be effectively nodulated by any strain of Rhizobia bacteria. True or false.

1) Virgin, acid
2) Yellowing, spindly growth, stunting
3) False

USING INOCULATED SEED

Commercial Rhizobium bacteria cultures have a lide of several months if stored in the refrigerater. Unnecessary exposure of inoculated seed to sunlight should be avoided. Once inoculated seed should be sown as soon as possible. The seed should not be mixed with acid superphosphate as this mixture will destroy the efficacy of the inoculum. Neutralised superphosphate can be used with safety. This is made by mixing ordinary superphosphate with ground carbonate of lime in equal quantities six weeks before use. An alternative method is to apply ordinary superphosphate with a fertiliser broadcaster or spreader, drill or combine and then drill in inoculted seed mixed with ground carbonate of lime.

1). Exposure to direct sunlight has a beneficial or detrimental effect on bacteria?

2). Superphosphate must be ---------- if sown with inoculated seed.

3) How long after inoculation should seed be sown? ----------

1) Detrimental
2) Neutralised
3) As soon as possible.

MAKING PEAT CULTURE

Peat cultures are available and a method used to inoculate seed is as follows:

1. Prepare a sugar solution by dissolving one tablespoon of sugar in one pint of water.

2. Prepare a peat slurry by adding a pint of sugar solution to the manufacturers directions for inoculating 8 kg of very small seeds eg white clover. Only small quatities of seed should be treated at any one time.

3. The seed should be spread on a clean cmant floor. Sprinkle the slurry over the seed until the seed and inoculum are mixed evenly.

4. Dry in the shade.

The use of dry peat inoculation is not recommended except in the case of lime pelleted seed, and then it should be used at double the normal rate. Inoculated seed should be sown into a moist seedbed to ensure rapid germination, otherwise the bacteria will not survive in dry soil. If the seed must be sown into a relatively dry seedbed, heavy rates of inoculum should be used.

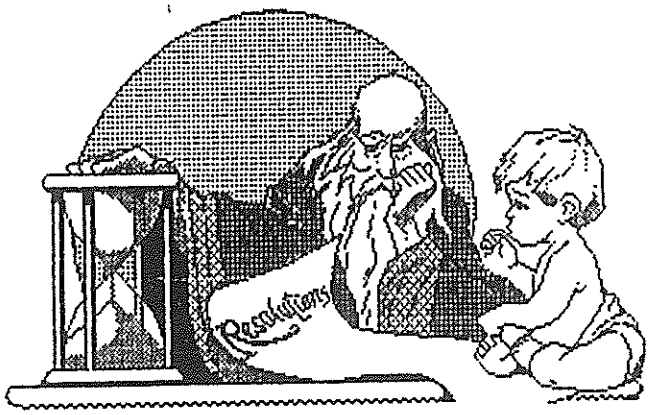
1) Why should heavier rates of inoculum be applied when sowing into a relatively dry seedbed?

2) What is the purpose of the sugar in the slurry?

3) Why do you think it is recommended that only small quantities of seed and inoculum be mixed at the one time?

DAIRYING

TURNING GRASS INTO MILK



2/

THE FOLLOWING ARE DAIRY GOAT AND CATTLE BREEDS

SAANEN
AYRESHIRE
FRIESIAN
JERSEY
GUERNSEY
BRITISH ALPINE
ANGLO NUBIAN
AUSTRALIAN ILLAWARA SHORTHORN (A.I.S.

FILL IN THE BLANK SPACES WITH THE HELP OF YOUR TEACHER
WRITE THE WHOLE PASSAGE IN YOUR BOOK.

The _____ goat is mainly a mixture of fawn, brown and black colours. It produces rich milk and its main features are a Roman nose and pedulous ( ) ears.
The most common( ) dairy goat breed in Australia is the white goat known as the _____. This breed produces a lot of milk and first came from Switzerland.
The other common dairy goat breed in Australia is the black and white breed _____ _____. This breed first came from Britain and it gives more milk than most other breeds.
The smallest of the dairy cattle breeds is the _____. It's milk is better than others for making butter and cheese because it is very rich in cream. This breed is fawn ( ) in colour.
A common breed in Australia which produces a large quantity ( ) of milk is known as the _____. It is a large animal which is black and white in colour.
The toffee and white coloured _____ originated ( ) in the Channel Islands of Britain. It produces milk that is good enough to make cheese from.
The red and white breed _____ is the dairy breed that first came from Australia. It produces large amounts of rich milk.

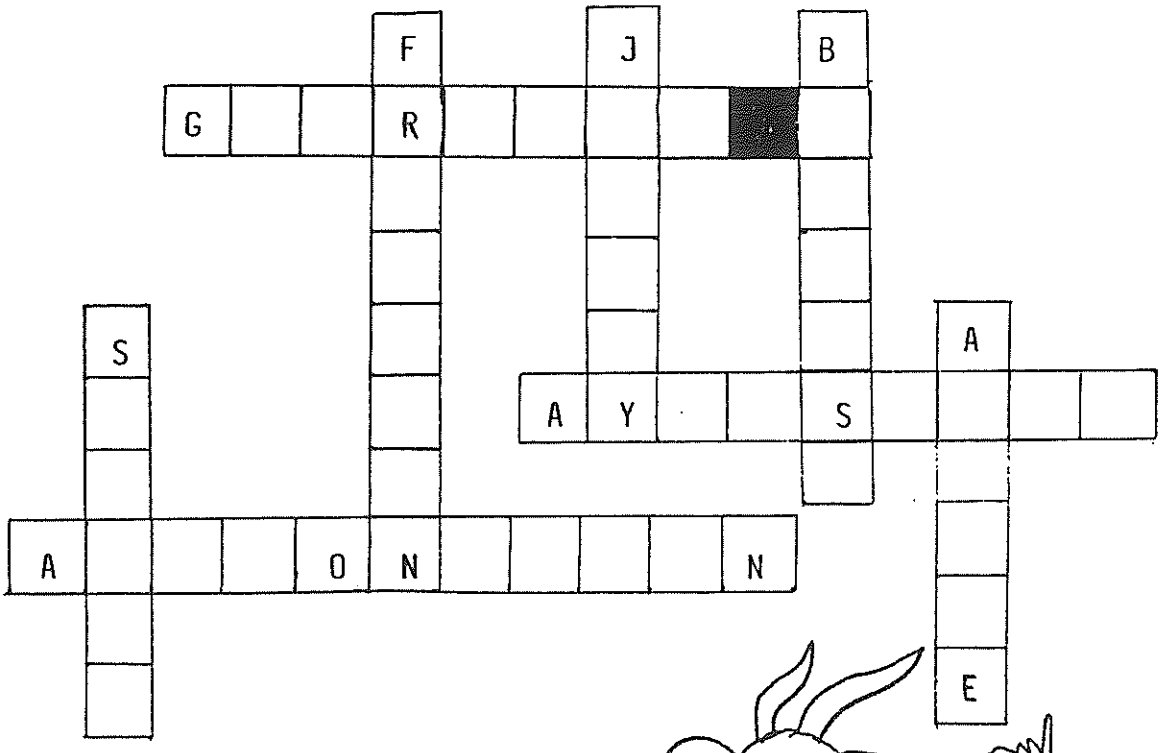
NOW LOOK UP THE WORDS THAT HAVE BRACKETS NEXT TO THEM IN YOUR DICTIONARY. PUT THE MEANING IN THE BRACKETS IN YOUR BOOK.

In your books, write a sentence that would describe these breeds.

1. AYRESHIRE
2. GUERNSEY
3. JERSEY
4. AUSTRALIAN ILLAWARA SHORTHORN (A.I.S.)

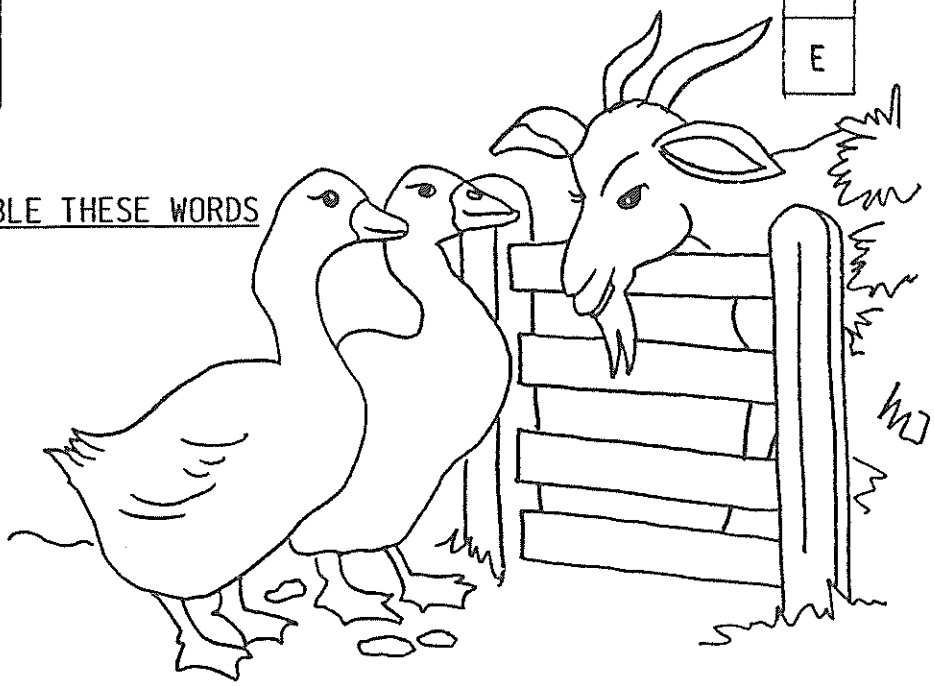
FUN TIME

This crossword is full of names of dairy breeds see if you can find them all.



UNJUMBLE THESE WORDS

rcaem
wafn
eebrd
klim
ogta

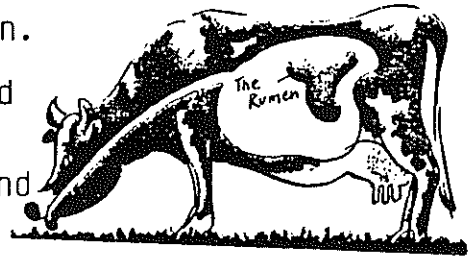


HOW DOES A COW TURN GRASS INTO MILK ?

Cows have a most unusual system for making grass into milk. They have not just one, but a series of four stomachs-each of which performs a special function.

1. THE RUMEN

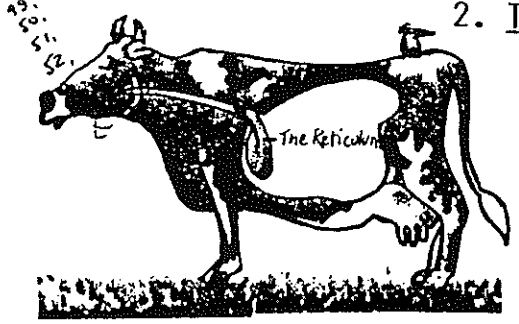
When cows graze on the grass they swallow it half chewed and store it in the first stomach called the Rumen. Here it is softened by fluids before moving to the second stomach.



1. The Rumen

2. THE RETICULUM

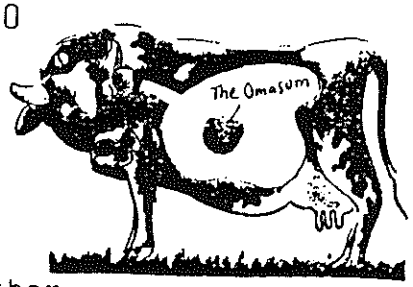
In the Reticulum the grass is made softer again and formed into small wads called 'cuds.' Each cud is then returned to the mouth where the cow chews it 40 to 60 times for about one minute.



2. The Reticulum

3. THE OMASUM

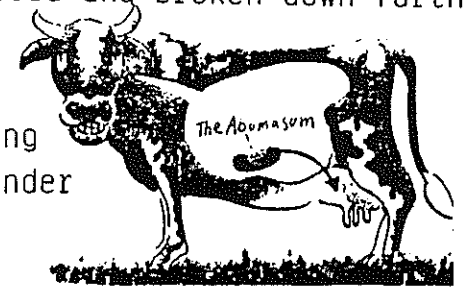
The chewed cud is swallowed into the third stomach, the Omasum, where it is pressed and broken down further.



3. The Omasum

4. THE ABOMASUM

The grass then passes to the fourth stomach, called the Abomasum where it is digested. Finally it passes down through the intestines where the cow takes everything out she needs to keep her strong and healthy. The remainder goes to the milk bag or the udder.



4. The Abomasum

BECAUSE A COW MAKES MILK NIGHT AND DAY, SHE NEEDS TO BE MILKED REGULARLY. IF THIS DOESN'T HAPPEN HER MILK PRODUCTION WILL CEASE.

5/

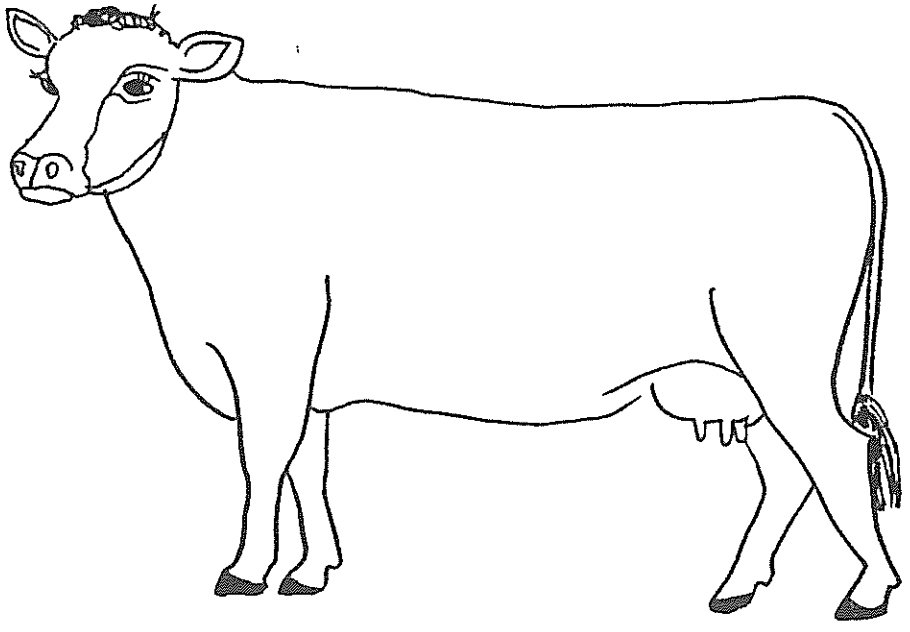
To produce good rich milk, cows must eat a lot of different grasses as well as clovers and bulky fodder.
When food is in short supply the farmer may also feed their cows millet, oats or hay.

READ "HOW DOES A COW TURN GRASS INTO MILK ?"
COPY THE FOLLOWING INTO YOUR BOOKS, FILLING IN THE BLANK SPACES AS YOU GO.

A cow eats _____. A cow has _____stomachs. When the food has been chewed, it passes into the Rumen. Here fluids _____ it. In the Reticulum the food is made softer and small _____ are formed. The cow chews this cud when it is returned to the _____.

Next, food goes to the Omasum where it is broken down further before it moves to the _____. In the Abomasum the food is _____ and then nutrients are taken out of the food when it is is the _____.

If a cow is not milked regularly she will _____ producing milk.



6/

HOW DOES MILK GET FROM THE COW TO YOU?

These days dairy farming is done with machines, but for hundreds of years cows were milked by hand. This was hard work because the whole herd would have to be rounded up and milked by hand twice a day.

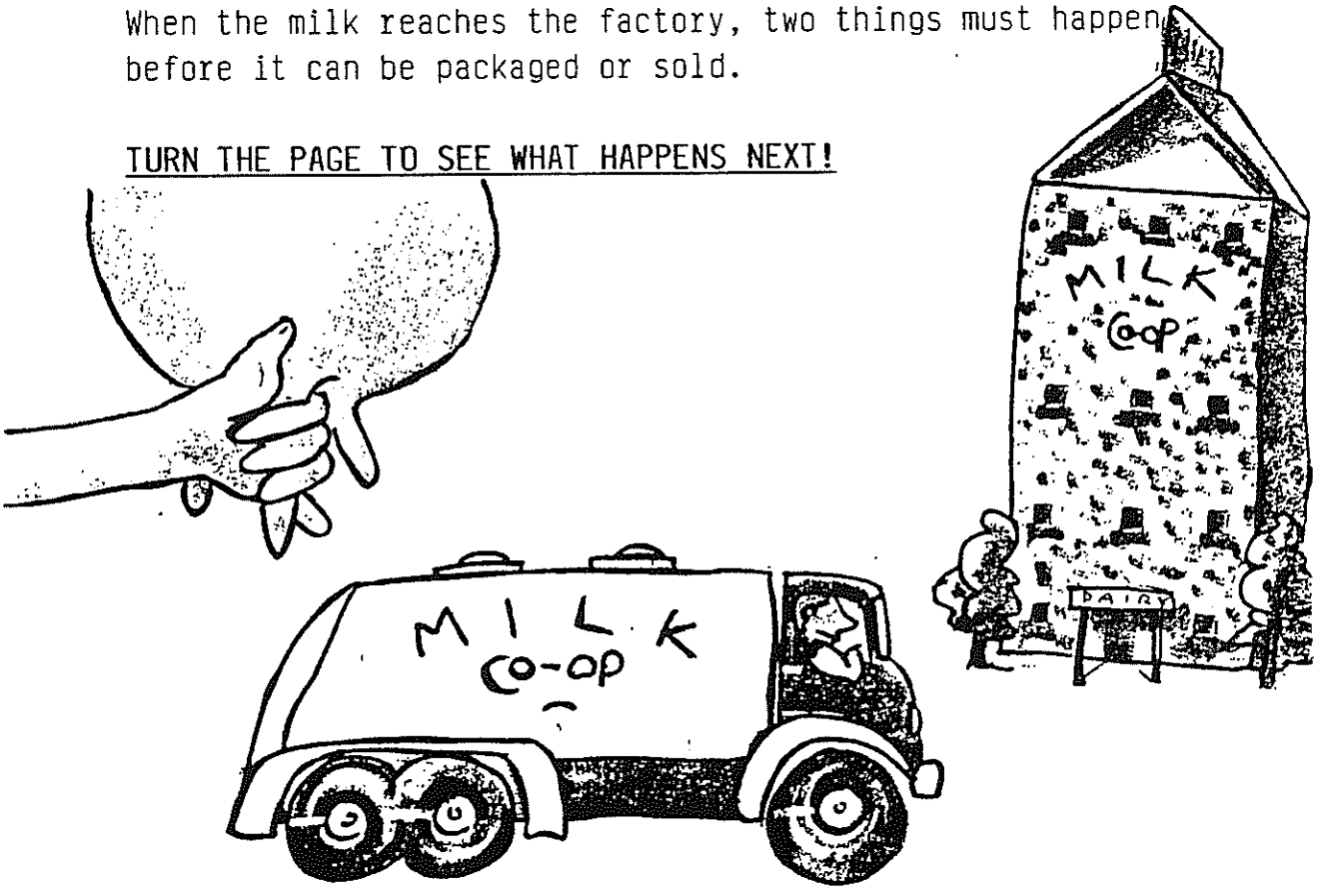
Cows still need to milked twice a day, but the way it is done is different. Nowadays milk is taken out (extracted) from the cows udder by a suction cap which is put on each teat. From here it travels through stainless steel pipes to a large refigerated container (vat) where it is stored and cooled.

A few hours after, the refrigerated milk tanker arrives at the farm to pick up the milk. The tanker then goes around to other farms to pick up their milk and takes it all to the factory.

Each year in Australia bulk tankers carry six billion litres of milk **from** farms **to** factories.

When the milk reaches the factory, two things must happen before it can be packaged or sold.

TURN THE PAGE TO SEE WHAT HAPPENS NEXT!



7/

TIME FOR THE FACTORY

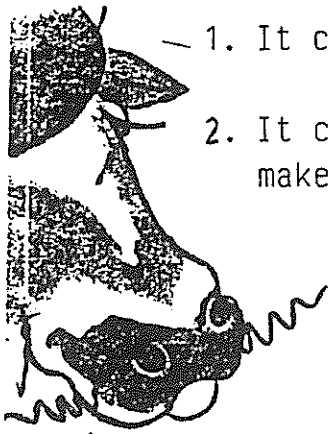
FIRST THE MILK IS PASTEURISED

Pasteurisation is named after a French chemist who invented it. His name was Louis Pasteur. It means that the milk is partly sterilised by heating it gently. This process kills off harmful bacteria (germs). It does not change the taste of the milk or take any goodness out of it.

NEXT THE MILK IS HOMOGENISED

Milk has cream in it. Cream is lighter than milk so it rises up to the surface (top) and stays there. When the milk is homogenised the cream is worked through the milk to make it creamy and smooth.

WHERE DOES THE MILK GO NEXT?



1. It can be packaged and sold as 'white milk' (in the carton)

2. It can be sold to manufacturers who will use it to make other dairy foods such as :
   - cream
   - yogurt
   - butter
   - cheese
   - ice cream

3. It can also be made into other types of milk such as :
   - skim milk
   - powdered milk
   - condensed milk
   - flavoured milk





8/

WHAT HAPPENS TO THE MILK AFTER THE COW HAS MADE IT?

READ "How does the milk get from the cow to you?" (page 6) THEN COPY THE SENTENCES INTO YOUR BOOK, FILLING IN THE BLANK SPACES AS YOU GO.

THE FARM

A dairy cow has to be milked _____times a day. A suction cap is put onto each of the cows _____ and milk is taken through stainless steel pipes to a large refrigerated _____ where the milk is stored and _____. The milk taken to the milk factory in _____.

THE FACTORY

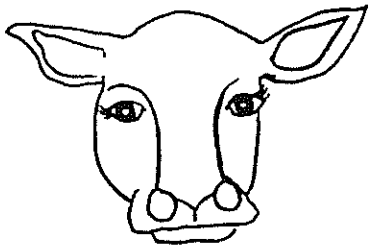
When the milk reaches the factory it is pasteurised. Pasteurisation is named after _____ who invented it.

Pasteurisation happens when the milk is partly sterilised. This is done by _____it gently. By doing this, the bacteria that is in the milk is _____. If it wasn't done the milk would not be allowed to be sold to the public.

Next the milk is homogenised. This is when the _____ is mixed evenly through the milk instead of settling on the _____.

Now the milk is sold as everyday milk or it can be made into several different types of milk such as s_____ m_____, p_____, _____, or _____.

Some of the milk is sold to manufacturers where it is made into other milk products such as b_____, _____, and _____.



9/

UNJUMBLE THESE WORDS

wocs
ksim
ttureb
ticsnou

FILL IN THE MISSING LETTERS

YOU WILL FIND THE WORDS ON PAGE 8

ref_igera_ _ _
_aste_ri_ed
sett_ing
h_m_genise_

ALL WORK IS TO BE WRITTEN IN YOUR BOOKS

FIND THESE WORDS

In your book, write down the number and the letter that points to the **first** letter of these words:

HEIFER
CALF
COW
BULL
STEER
PODDY
LACTATION
HOMOGENISED
PASTEURISED
SKIMMED

	1	2	3	4	5	6	7	8	9	10	11
A	H	O	M	O	G	E	N	I	S	E	D
B	I	C	O	W	U	S	C	N	J	P	A
C	C	A	Y	E	U	D	O	I	B	L	M
D	H	L	F	Z	W	X	H	A	K	R	T
E	D	F	R	G	S	K	I	M	M	E	D
F	J	K	H	E	I	F	E	R	M	B	L
G	Z	S	T	U	B	X	G	Q	N	U	K
H	L	A	C	T	A	T	I	O	N	L	F
I	A	L	F	M	O	A	C	B	G	L	E
J	E	P	P	O	D	D	Y	D	J	H	I
K	P	A	S	T	E	U	R	I	S	E	D
L	W	N	Y	S	T	E	E	R	V	O	P

10/

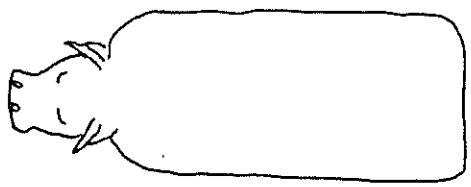
TERMS

HEIFER, CALF, COW, BULL, STEER, PODDY, DRY COW, LACTATION,

HOMOGENISED, PASTEURISED, SKIMMED

PLACE THE CORRECT WORD IN THE CORRECT SENTENCES.

1. The _____ was about to give birth to her first calf.
2. The _____ drank the milk of its mother.
3. The _____ took care of its calf
4. The bull became a _____ after castration.
5. The _____ was the father of the calf.
6. The young _____ calf was bucket fed.
7. After rearing her calf the ____ _____ rested in the paddock.
8. Cows produce milk during _____.
9. After the milk was _____ the milk and cream was separated.
10. The milk was _____ to kill germs.
11. The cream was _____ from the top of the milk.



11/

MAKING BUTTER

Butter is a simple product to make. All you need is:

1. 300 ml. cream
2. A very clean jar (500 ml.) with a screw top lid.

Give the cream a gentle stir then pour it into your jar. Screw on the lid and shake the jar for 12 minutes.

After 12 minutes, stop and have a look in the jar. The cream has turned into butter and a liquid called buttermilk. Taste the butter and the buttermilk.

ANSWER THE QUESTIONS

1. What did you do in this experiment?

_____

_____

_____

2. What happened to the cream?

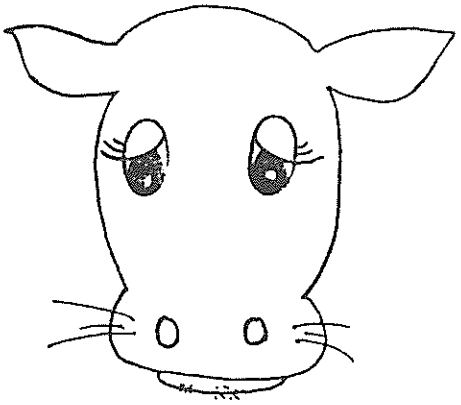
_____

_____

3. What did the butter taste like?

_____

_____



12/

MAKING YOGHURT

This is how yoghurt is made.

You need to:

1. Pour 500ml. of milk into a clean beaker.
2. Heat the milk to 70°C. The milk will form a skin on top.
3. Cool to 47°C
4. Add two tablespoons of natural yoghurt
5. Cover the beaker with a watchglass and wrap the beaker in a towel.
6. Leave overnight.

ANSWER THESE QUESTIONS

1. Why did we heat the milk to 70°C?

   _____

   _____

2. Why was natural yoghurt added to the milk?

   _____

   _____

3. What happened when we left it overnight?

   _____

   _____

4. Use the dictionary to find the meaning of these words:

   PASTEURISATION

   CURDLED

5. Why did we wrap the beaker in a towel?

   _____

   _____

13/

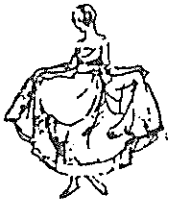
THE KING'S BREAKFAST



The King asked
The Queen, and
The Queen asked
The Dairymaid:
"Could we have some butter for
The Royal slice of bread?"
The Queen asked
The Dairymaid,
The Dairymaid
Said, "Certainly,
I'll go and tell
The cow
Now
Before she goes to bed."





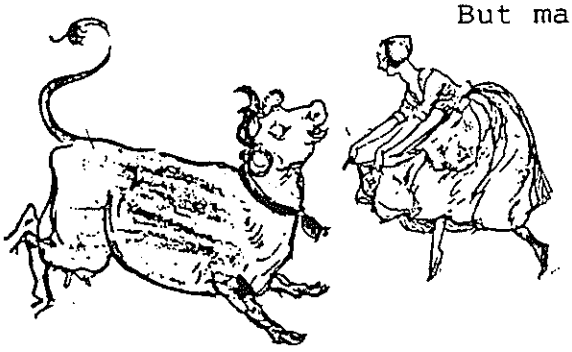


The Dairymaid
She curtsied,
And went and told
The Alderney:
"Don't forget the butter for
The Royal slice of bread."
The Alderney
Said sleepily:
"You'd better tell
His Majesty
That many people nowadays
Like marmalade
Instead."



14/

The Dairymaid
Said, "Fancy!"
And went to
Her Majesty.
She curtsied to the Queen, and
She turned a little red:
"Excuse me,
Your Majesty,
For taking of
The liberty,
But marmalade is tasty, if
It's very
Thickly
Spread."



The Queen said
"Oh!"
And went to
His Majesty:
"Talking of the butter for
The Royal slice of bread,
Many people
Think that
Marmalade
Is nicer.
Would you like to try a little
Marmalade
Instead?"

§§§§§§§§§§§§§



15/

POEM - KING'S BREAKFAST

NOW ANSWER THESE QUESTIONS IN YOUR BOOKS:

1. What do we get from a cow?

   _____

   _____

2. The King uses milk for his porridger (porridge). What does he use on his bread?

   _____

3. What did the Dairymaid tell the Aldeney to tell His Majesty? (Look at the second verse)

   _____

   _____

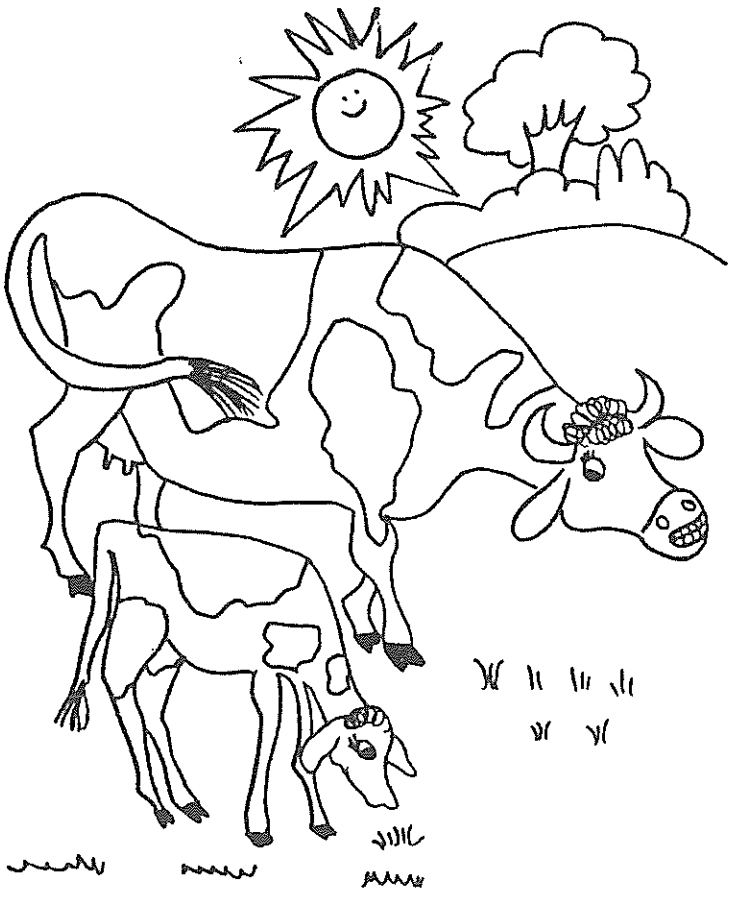
4. Place these words in the sentences.

   BUTTERFAT CHURNED

   The _____ from milk is _____ to make it solid.

5. Use the dictionary to find out what these words mean.

   CHURNED BUTTERFAT MILK

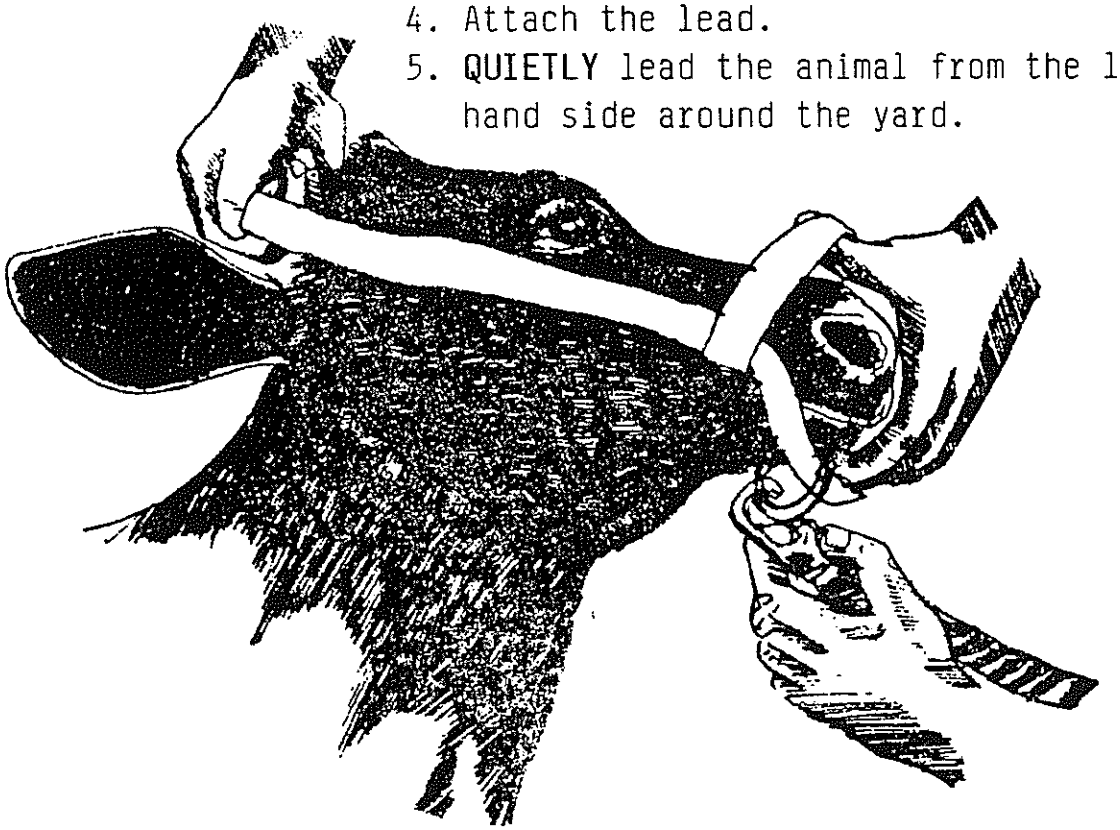


USING A LEAD ON AN ANIMAL

Skill: Using a lead on an animal
Objectives: Put a halter and lead on an animal
Lead an animal

Materials Given: Steer or heifer
Halter and lead

Procedure:
1. Yard the animal.
2. Put the animal in a race.
3. Slip the halter over the head.
4. Attach the lead.
5. **QUIETLY** lead the animal from the left hand side around the yard.



HAS ATTEMPTED
MASTERED

THIS SKILL

COMMENT _____
TEACHER'S SIGNATURE _____
STUDENT'S SIGNATURE _____
DATE _____

MASTERY CERTIFICATE

DAIRYING

This certificate is an indication that

_____

has mastered the following skills .

a) Writing a sentence using the terms of the topic .

b) Can handle an animal correctly .

c) Can spell 6/10 words .

d) Can follow written instructions .

e) Can answer comprehension questions .

f) Can use a dictionary to find the meanings of selected words .

g) Can identify and write simple descriptions of the various dairy breeds .

Date _____ Signed _____

AGRICULTURE WORKSHEET

Developed by Dunheved and Shalvey High Schools.

TEACHERS NOTES :

Name _____ Class _____

BASIC HORTICULTURE

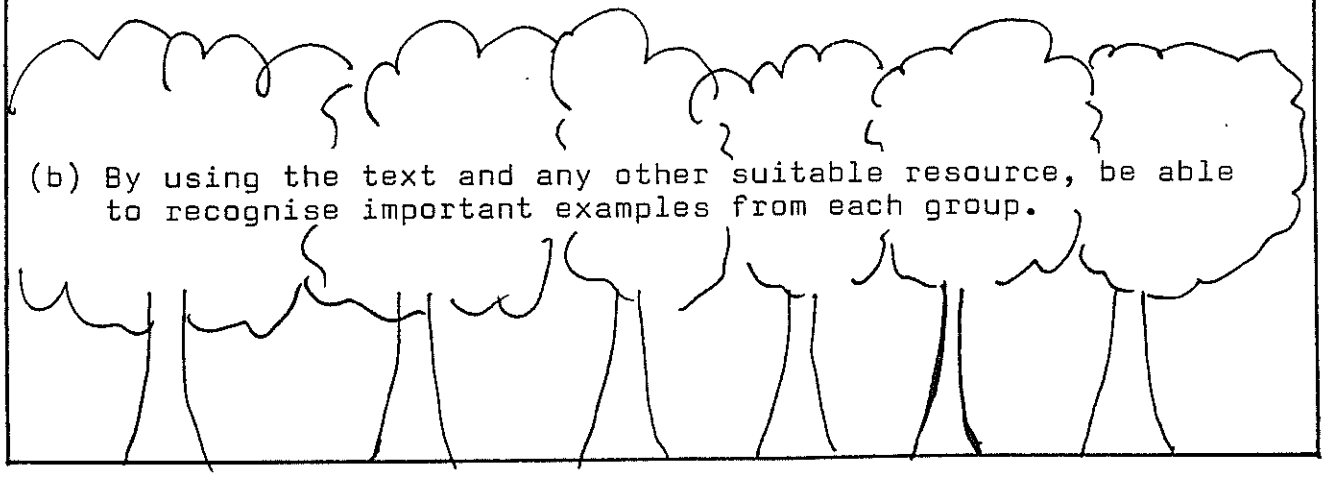
Types of Orchard Trees

Using the textbook, Agricultural Studies 1 , write down examples of orchard trees from the groups ; citrus, stone, pome & vine.

CITRUS STONE POME VINE

(a) Draw one example of a fruit from each of the above groups. (If possible, colour it in to assist in recognition of the fruit).

CITRUS	STONE
POME	VINE



(b) By using the text and any other suitable resource, be able to recognise important examples from each group.

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TEACHERS NOTES:

Name _____ Class _____

BASIC HORTICULTURE

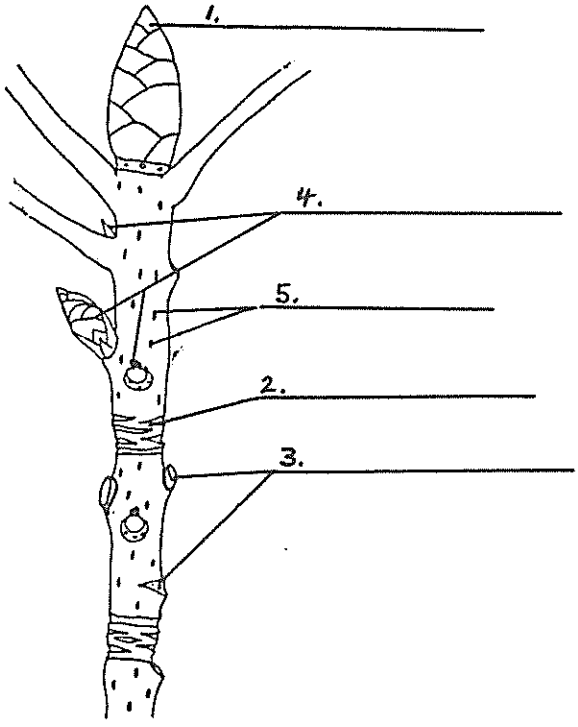
Structure of a Woody Twig

A bud is a condeneed shoot system and are covered by bud scales (modified leaves) which prevent injury and desiccation.

* Label the following features on the diagram below of a woody twig.

1. Terminal Bud - formed at the end of the last growing season.
2. Bud Scale Scar - marking position of terminal bud of previous growing season.
3. Leaf Scar - marking position of deciduous leaves.
4. Axillary buds - in axils of leaf scars.
5. Lenticels - pores or breathing holes in the bark.

EXTERNAL FEATURES OF A WOODY TWIG.



Mark in last season's growth and the previous season's growth on the diagram.

QUESTIONS. Copy questions into your notebook and answer them.

1. What years does each seasonal growth period represent ?
2. How old is the above twig ?
3. What is a bud and what is its function?
4. What is the function of the lenticels?
5. What are deciduous leaves ?

AGRICULTURE WORKSHEET

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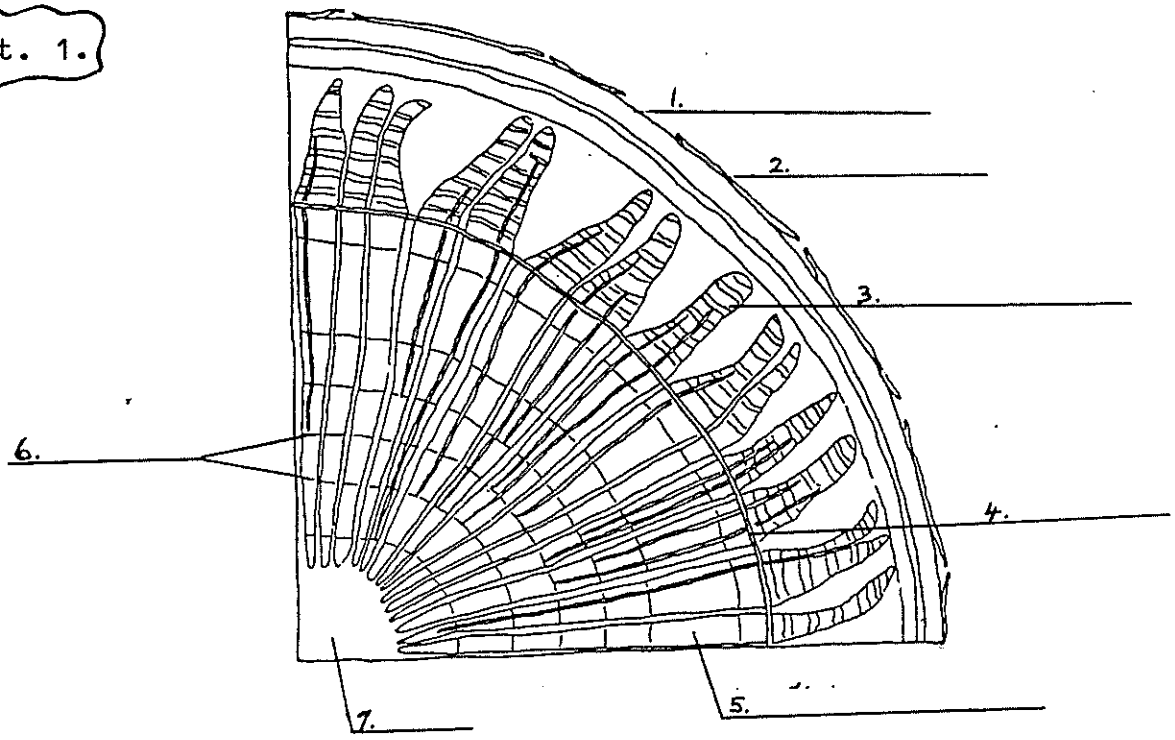
TEACHERS NOTES: To be used in conjunction with Part 2.

Name _____ Class _____

Transverse Section (T.S.) of a Woody Twig.

Map Diagram of the ¼ T.S. of a Woody Twig.

Part. 1.



Copy the diagram above into your notebook, showing layers of cells and not details of cell structures.

* Label the following features on the diagram.

1. lenticels
2. bark
3. food transporting cells (called phloem cells)
4. cambium
5. water conducting cells (called xylem cells)
6. growth rings
7. pith

AGRICULTURE WORKSHEET

Developed by Dunheved High and Shalvey High Schools,

TEACHERS NOTES: To be used in conjunction with Part 1.

Name _____ Class _____

TRANSVERSE SECTION (T.S.) of a WOODY TWIG.

Part. 2.

* The cambium layer is a specialised group of cells which produces new food transporting cells towards the outside of the plant and new water conducting cells towards the centre or inside the plant. Thus the cambium is directly involved in the growth of plants as it is involved in producing new cells.

* Water conducting cells take water and dissolved nutrients UP the plant, while food tranporting cells take food produced in the leaves DOWN to other parts of the plant.

* Growth rings found in water conducting cells, indicate the age of the woody plant. Growth rings are closer together or become more compressed as you towards the centre of the plant.
Generally, the older the plant, the greater the number of growth rings and the smaller is the pith area in the centre of the plant. Some Redwoods in California have over 2000 growth rings - so these go back to B.C. in the time scale.

* Ringbarking is a method of killing trees where the food transporting cells are removed from the plant. It was an old and effective method of removing excessive numbers of trees from grazing areas. When these cells are removed or damaged, the plant eventually dies as its transport system is permanently damaged.

QUESTIONS

1. What is the function of the cambium ? _____

_____

2. Which direction does water move in plants ? _____

3. Which direction does food move in plants ? _____

4. What is ringbarking ? _____

_____

5. Looking at the diagram on Part 1. What is the age of the tree by counting the growth rings.

_____

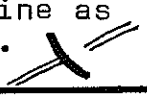
AGRICULTURE WORKSHEET

Developed by Dunheved High and Shalvey High Schools.

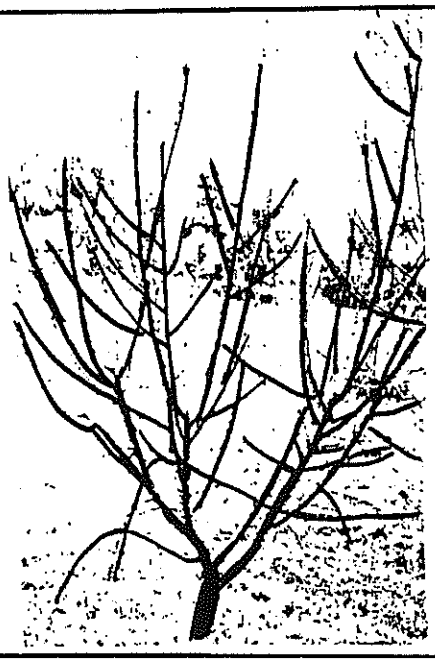
TEACHERS NOTES:

Name _____ Class _____

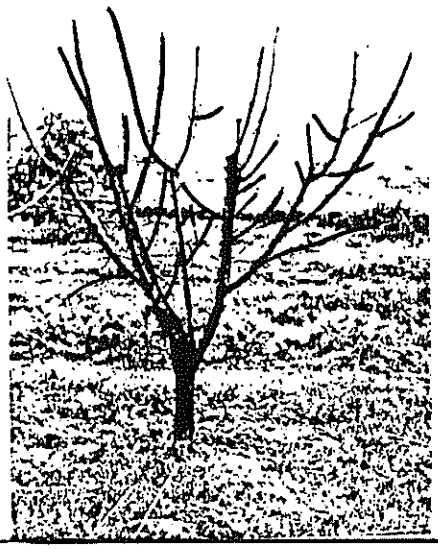
PRUNING

Compare the 2 pictures A & B . On picture A draw a line as shown, across those shoots (laterals) which were cut eg. 

A



B



Examine the tools used for pruning below. They are labelled, and numbered 1 to 4.

(i) Which one is used to remove small growth, and material which is not very thick ? _____

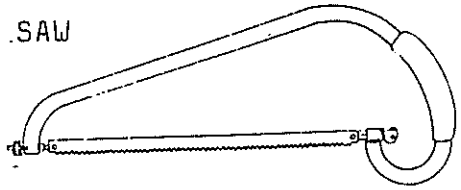
(ii) Which item is used to control growth which is high off the ground ? _____

(iii) What would the saws be used for ? _____

_____

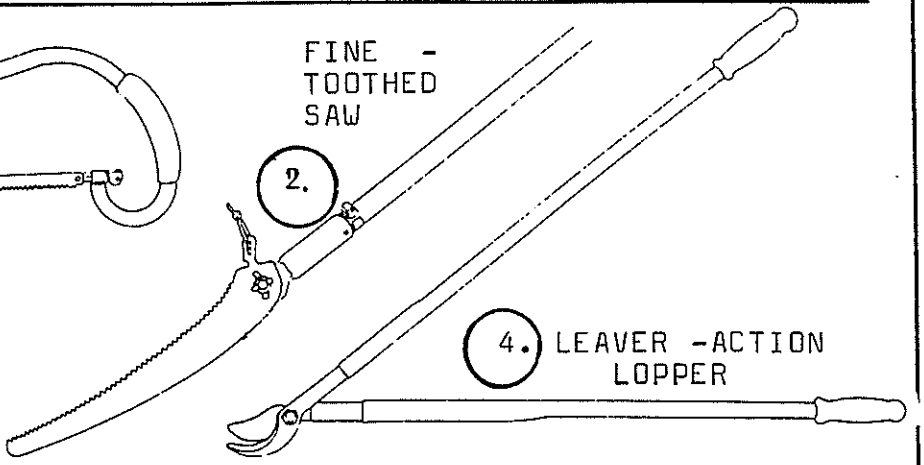
BOW SAW

1.



FINE - TOOTHED SAW

2.



3. SECATEURS



4. LEAVER -ACTION LOPPER

AGRICULTURE WORKSHEET

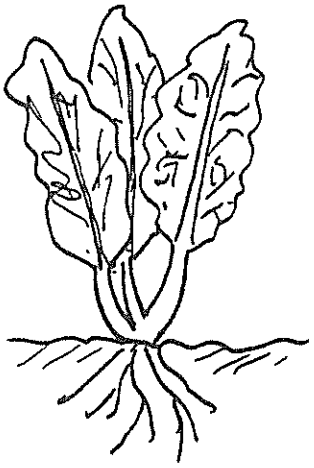
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TYPES OF VEGETABLES

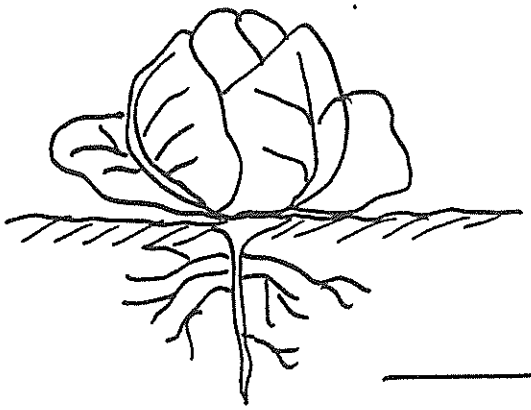
We eat different parts of many vegetables.

1. SOME ARE GROWN FOR THEIR LEAVES

Name these vegetables.

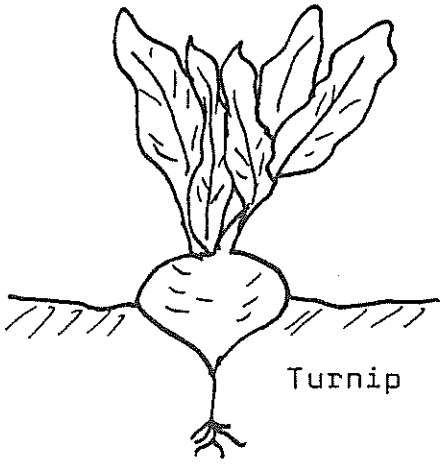


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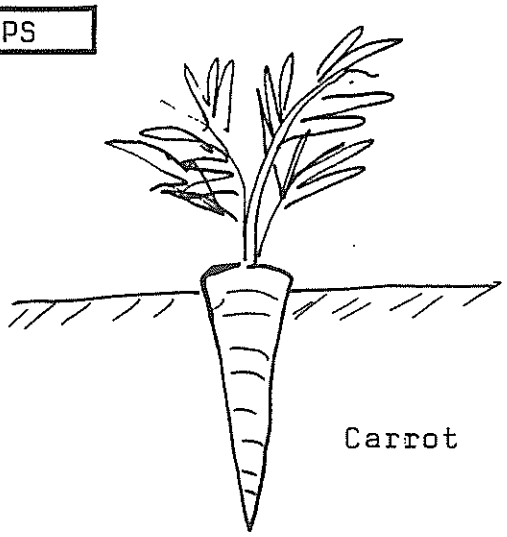


_____

2. SOME ARE CALLED ROOT CROPS



Turnip

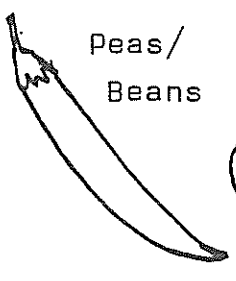


Carrot

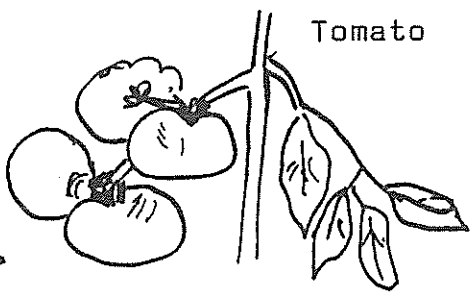
Name two more root crops. 1. _____

2. _____

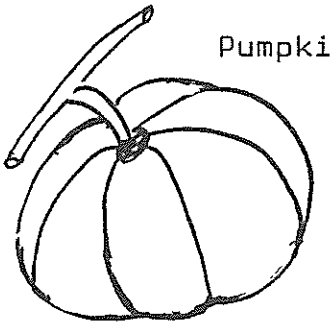
3. SOME VEGETABLES HAVE EDIBLE FRUITS



Peas/ Beans



Tomato



Pumpkins

* How do you recognise a fruit? _____

AGRICULTURE WORKSHEET

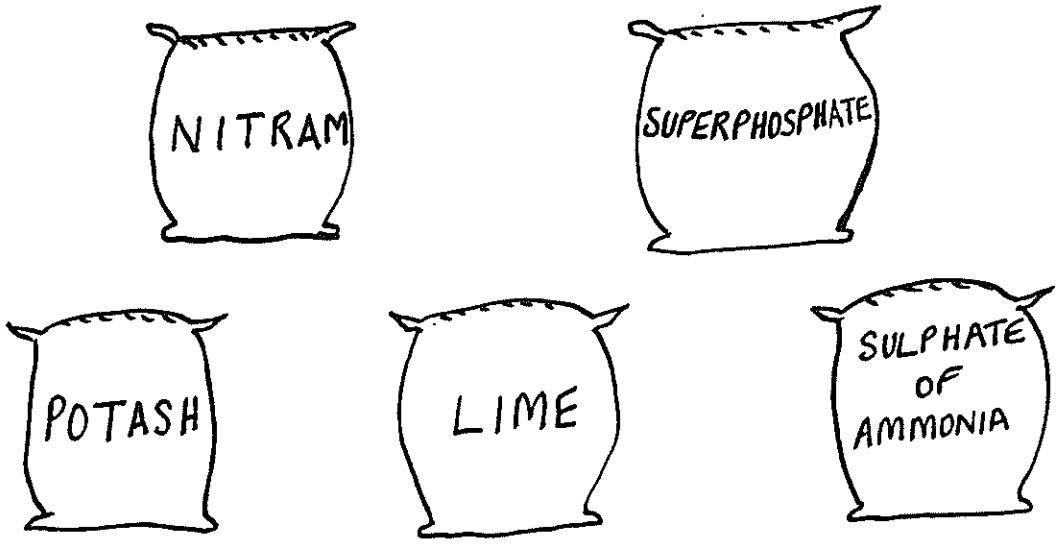
Developed by Dunheved High and Shalvey High Schools.

TEACHERS NOTES:

Name _____ Class _____

FERTILIZERS

Below are some bags of fertilizer .



QUESTIONS :

1 Which fertilizer is used to improve the PHOSPHORUS in the soil?

_____

2. Name one fertilizer which is used to improve the Nitrogen in the soil . _____

3. The chemical formula for POTASH is KOH . What element does it add to the soil ? _____

4. Sulphate of Ammonia is often added to lawns to make them green. It's formula is $(HH4)_2SO4$. It adds SULPHUR and what other element to the soil ? _____

5. Unfortunately Sulphate of Ammonia can also make soil acidic. How can this be corrected ? _____

_____

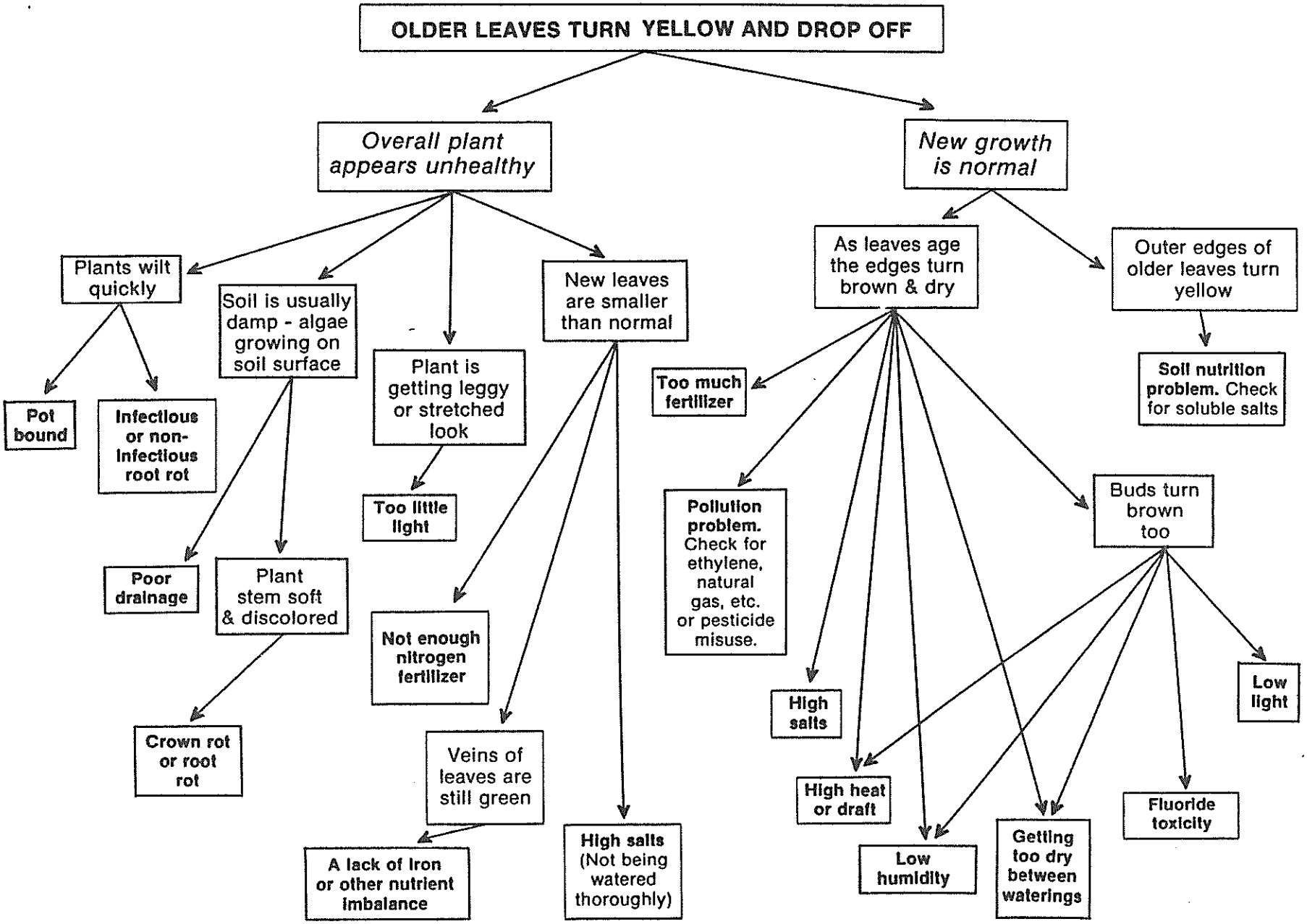


Figure 86. Key for diagnosing plant problems - Part II.

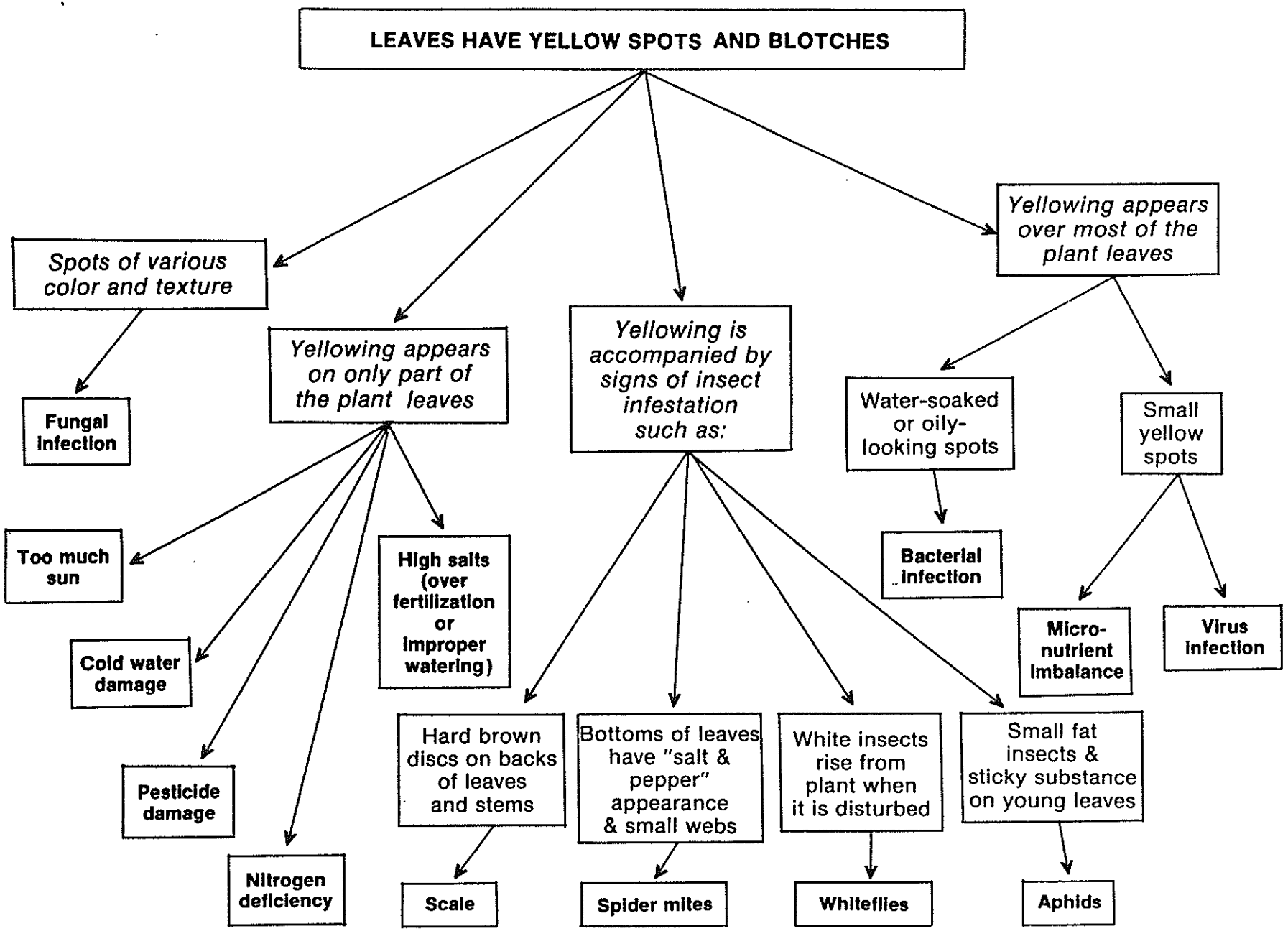


Figure 86. Key for diagnosing plant problems - Part I.

NUTRIENT DEFICIENCY DIAGNOSIS

Chlorosis = strong yellowing. Necrosis = dead tissue.

A Effects localized on older leaves or more or less general on the whole plant. .....B

A1. Effects localized on terminal growth, upper and bud leaves. .....E

B Local; occurring as mottling or chlorosis with or without necrotic spotting of lower leaves, little or no drying of lower leaves. C

B1 General; also yellowing and drying of lower leaves.....D

C Lower leaves curved or cupped under with yellowish mottling at tips and margins . Necrotic spots at tips and margins. Potassium.

C1 Lower leaves chlorotic between the principal veins at tips, and margins of a light - green to white colour. Typically no necrotic spots. Magnesium

D Plant light green , lower leaves yellow, drying to light brown. Nitrogen.

D1 Plants dark green , leaves narrow in proportion to length; plants immature. Phosphorus.

E Dieback of terminal bud, preceded by distortions and necrosis at tips or base of young leaves making up terminal growth. .....F

E1 Terminal buds remains alive, chlorosis of upper leaves , with or without necrotic spots, veins light or dark green. .....G

F Young leaves making up the terminal bud first light green followed by a typical hooking downwards at tip, followed by necrosis , so that if later growth occurs tips and margins of upper leaves are missing. Calcium.

F1 Young leaves constricted and light green at base, followed by more or less decomposition at leaf base; if later growth takes place show a twisted or distorted development; broken leaves show blackening of vascular tissue. Boron.

G Young leaves with necrotic spots scattered over chlorotic leaf, smallest veins tend to remain green, produces checkered effect. Manganese.

G1 Young leaves without necrotic spots, chlorosis does or does not involve veins so as to make them dark or light green. .....H

H Young leaf tissue and veins same colour. Light green never white or yellow, Lower leaves do not dry up. Sulphur

H1 Young leaves chlorotic; main veins darker green than tissue. I

I Whole leaf pale yellow or white. Iron

I1 Interveinal chlorosis persists. .....J

J Terminal growth restricted to form a rosette. Zinc

J1 Dieback at tips and edges of leaves. Copper.

AGRICULTURE WORKSHEET

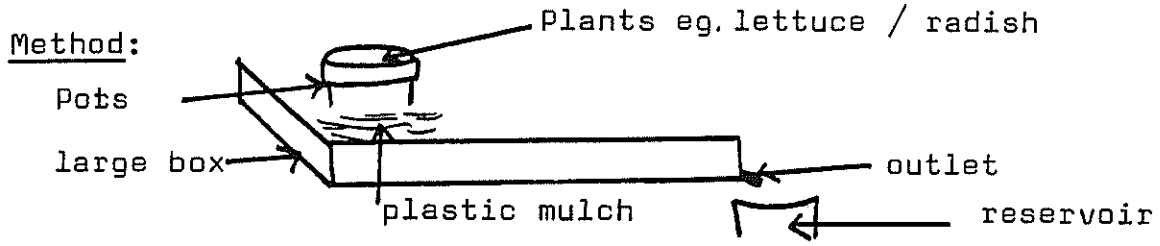
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TEACHERS NOTES:

HYDROPONICS

AIM : To grow a soil'less culture of plants.

Method:



* Irrigate 1 / day
* Renew solutions every 10 days.
* Completely flush once every 10 weeks.
* PH requires - 7 , check 1/ week with universal indicator.
* suitable potting mixes are :
  vermiculite, sand, brick, granite, shale , quartzite.

NUTRIENT FORMULAE

1.General		2.Winter		3.Spring- Autumn	
$K_3(PO4)_2$	7.1g	$K_3(PO4)_2$	6.7g	$MgSO_4$	5.8g
$Ca(NO_3)$	24.0g	$MgSO_4$	8.7g	SPO_4	6.8g
$Mg\ SO_4$	13.0g	Super PO_4	10.2g	KNO_3	19.1g
$NH4_2\ SO_4$	2.1g	Pot nitrate	14.4g	NH_2SO_4	5.8g
H_2O	5 gallons	Ammon.Sulphate	4.7g	H_2O	5 gallons
		H_2O	5 gallons		

Trace elements: add small solution of a compounded amount.

General Purpose culture media:

KNO_3	0.01g
$Ca(NO_3)_2$	0.001g
K_2HPO_4	0.002g
$Mg\ SO_4$	0.001g
$FeCl_3$	0.00001g

Distilled water to 1000 ml.

Trace Element solution
(Hoagland, Snyder)

lithium chloride	0.028g
copper sulphate	0.0556g
zinc sulphate	0.0556g
boric acid	0.6110g
aluminium sulphate	0.0556g
stannous chloride	0.0278g
manganese chloride	0.3889g
nickel sulphate	0.0556g
colbalt nitrate	0.0556g
autunium oxide	0.0556g
potassium iodide	0.0278g
potassium bromide	0.0278g
glass- distilled water to	1000 ml.

N.B When required add **1** ml of this solution to 1 litre of the culture medium.

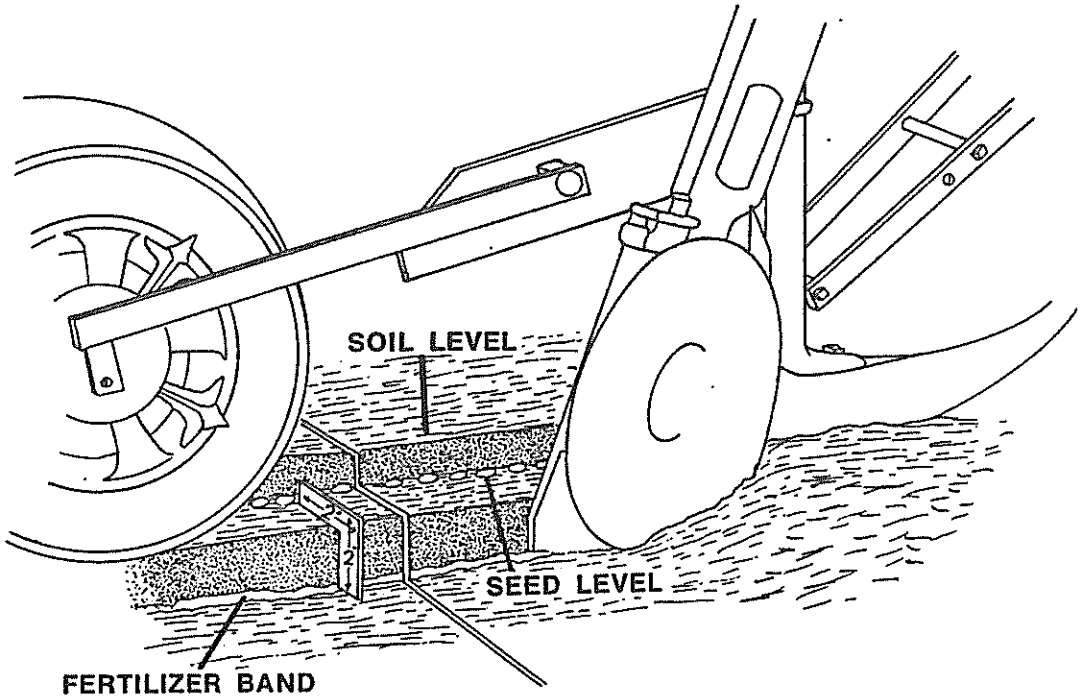
AGRICULTURAL WORKSHEET

Developed by Dunheved High and Shalvey High Schools.

TEACHERS NOTES:

Name _____ Class _____

PLACING STARTER FERTILIZER IN BANDS



* Explain how the fertilizer is placed into the soil.

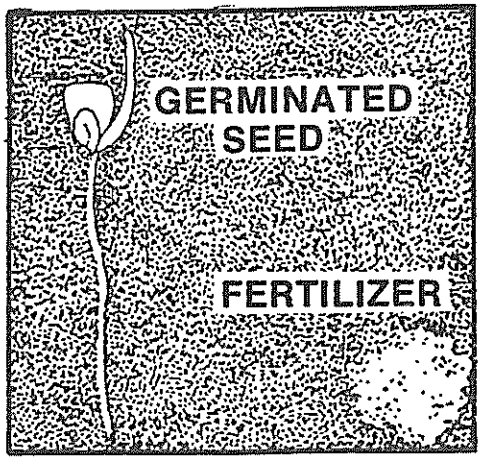
_____

_____

* Why is the fertilizer placed way from the seed?

_____

* Look at the diagram below, in the blank space carefully draw how you would expect the seeds root system to grow.



AGRICULTURE WORKSHEET

Developed by Dunheved High and Shalvey High Schools.

TEACHERS NOTES:

Name _____ Class _____

GERMINATION REQUIREMENTS

Temperature Table

Crop	Degrees Fahrenheit			
	Minimum Range		Optimum Range	
	°F	°C	°F	°C
Corn	48 - 50	8.9 - 10.0	70 - 80	21.1 - 26.7
Soybeans	50 - 54	10.0 - 12.2	65 - 75	18.3 - 23.9
Wheat	34 - 36	1.1 - 2.2	59 - 65	15.0 - 18.3
Oats	34 - 36	1.1 - 2.2	59 - 68	15.0 - 20.0
Sorghum	48 - 50	8.9 - 10.0	70 - 80	21.1 - 26.7

1. On the axis below use either a bar graph or a column graph to show this information in the table above. Use (° C) figures only.

2. From the above information, which crops grow in summer ?

_____

3. From the above information, which crops grow in winter ?

_____

AGRICULTURE WORKSHEET

Developed by Dunheved High and Shalvey High Schools.

TEACHERS NOTES:

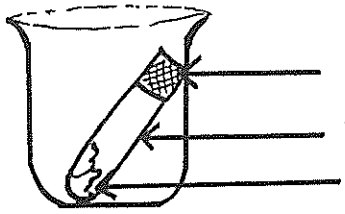
Part 2 Name _____ Class _____

PLANTS

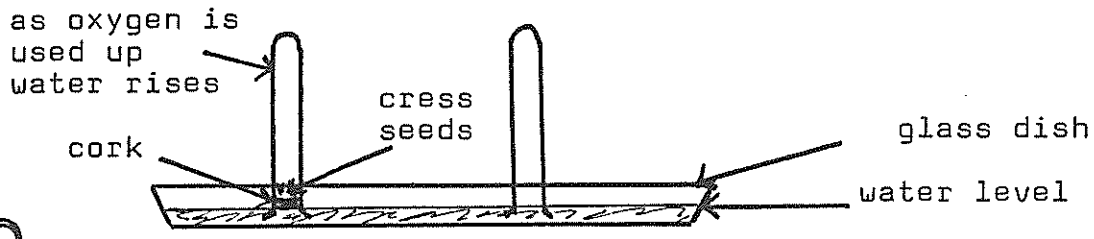
MODE 1

GERMINATION EXPERIMENTS

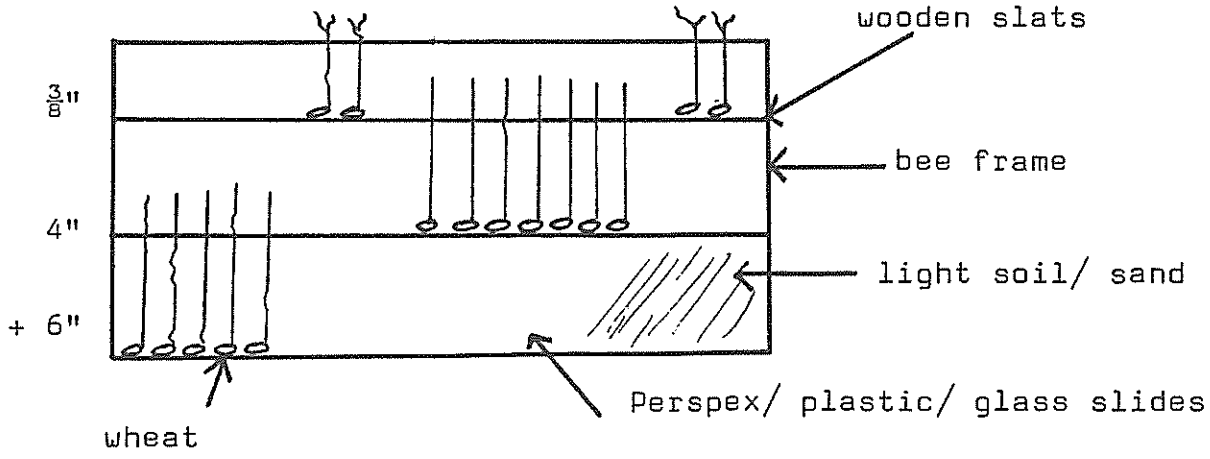
1. AIM : To study absorption of water by plants.



2 AIM : To study if oxygen is used up in seed germination.



3 AIM: To study the effect of seed germination with depth.



AGRICULTURE WORKSHEET

Developed by Dunheved High and Shalvey High Schools.

TEACHERS NOTES:

Part 1

Name _____ Class _____

PLANTS

MODE 1

AIM : To determine what factors affect seed germination

Method: Students , given guidelines and suitable equipment, construct experiments to describe the following.

1). Seed purity and viability tests.

* 5 g sample prepared / 2 students.
* students sort samples into Pureseed, foreign seed, junk .
* express results as % of seed material.
* for germination 20 seeds we placed into a petri dish, and allowed to germinate - express germination as %.
  Seed value is calculated as -

$$\frac{\text{Purity} \times \text{germination \%}}{100}$$

  Examine the seed packet for 1) Dating 2) Alfoil packing.

2). Seeds need moisture for germination for chemical and enzyme activity, using watch glasses test for this with wheat seeds.

3). Tests for adequate oxygen, to allow for respiration, do so with beanseeds after covering with paraffin.

4). Tests for suitable temperatures:

Tests involves use of refrigerator, room temperature, sealed heat can.

5). Lead students to the realization that light is not a necessity for germination, in fact seedlings often are commercially 'started' in the dark.

RAISING PLANTS

Where early raising of frost sensitive plants is required eg. tomatoes, squash, NZ spinach, 2 methods are employed.

AGRICULTURE WORKSHEET

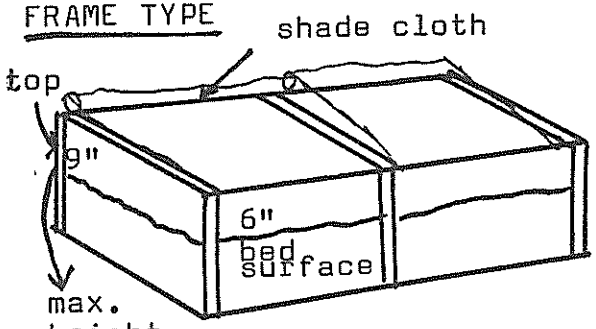
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TEACHERS NOTES:

1. (a) HOT BEDS

* Usual (4' x 5 ')
* Soil removed to depth of 12".
* Frame of wood fitted around edges of the bed. (15" high at back, 12" front, drainage off glass top).
* Hole is then filled with 12" of fresh manure, this is built up in 3" layers, each of which is well trampled.
* Once firmly packed down, cover with 3" layer of soil.
* Why is this called a hot bed? (What is the use of manure).
  Fermentation produces heat from manure = 100°F.
* Place seed boxes and seed on ashes in the frame.

FRAME TYPE



(a) Use thermometer to stabilize temp. at 80°F.
(b) Cover with plastic once temp .is stable.
(c) Cover with canvas.
(d) Watch ventilation.

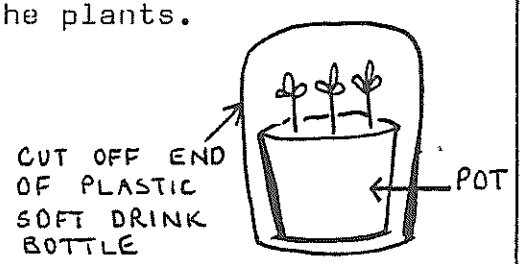
1.(b) COLD FRAMES

Where it is not necessary to provide additional heat from nanure:
* Soil bed dug within the frame, left open - hence a good tilt + mineral needs - satisfy all germination requirements.

2. HOT CAPS

Small tents fitted over the plants.

1. Frost protection.
2. Rain protection.
3. Warmth.



EXERCISE:

Compare and contrast growth rates of plants in the 3 situations.

HOT BEDS.	COLD FRAMES	HOT CAPS.

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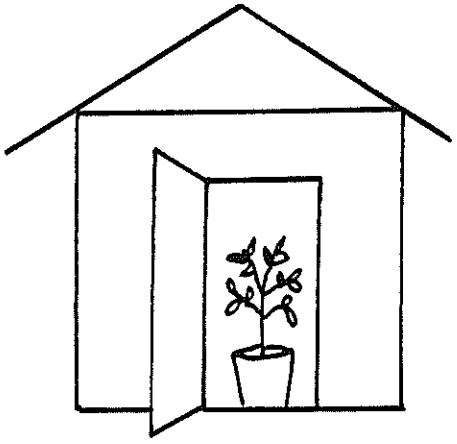
TEACHERS NOTES:

Name _____ Class _____

Propagation of Indoor Plants.

Some indoor plants which are relatively easy to propagate include :

BEGONIA	Leaf section, tip cuttings.
COLEUS	Tip cutting.
AFRICAN VIOLETS	Leaf cutting.
PINEAPPLE	Stem base cuttings.
GLOXINIA	Leaf cutting.
RUBBER PLANT	Leaf cutting.
MONSTERIA	Tip cutting.
PHILODENDRON	Aerial layering.
IVY	Sectional stem cutting.
ASPIDISTRA	Clump division.
FERNS	Plantlets on frond surface.
CACTI & SUCCULENTS	Cutting, budding, grafting, leaf cuttings.
HOYA/NATIVES	Leaf cutting.



* From the above list , describe or draw what happens after 3 weeks.

YOUR NOTES

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TEACHERS NOTES :

Name _____ Class _____

TO GROW SOME PLANTS *VEGETATIVELY*

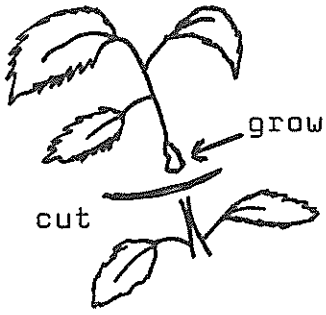
1). Stem Cuttings: (Summer Early Autumn)

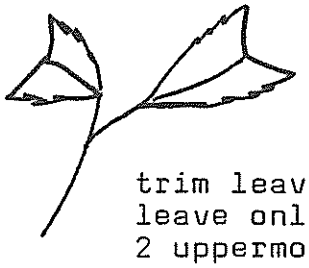
3 types : Softwood taken when wood is soft in spring and early summer.

: Medium - taken during summer and early Autumn.

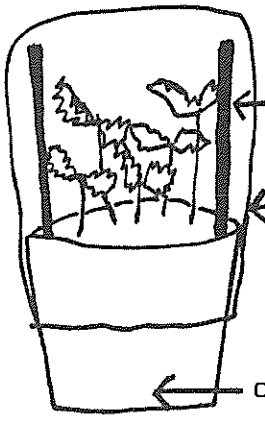
: Hardwood - taken Autumn and Winter.

CAMELIA : February is a good time for these cuttings. The best cuttings are the growing ends of the stems about 100 mm long. Cut it close under one of its nodes, from a previous years flowering. Trim leaves as shown, and insert at least half their length into the bed. Use hormonal treatments as directed. Leave until Spring or at least 10 -12 weeks.





trim leaves or leave only the 2 uppermost leaves.



SAME FOR AZALEAS (in February) use current growth.

RHODODENDRONS (shave one side at base).

AGRICULTURE WORKSHEET

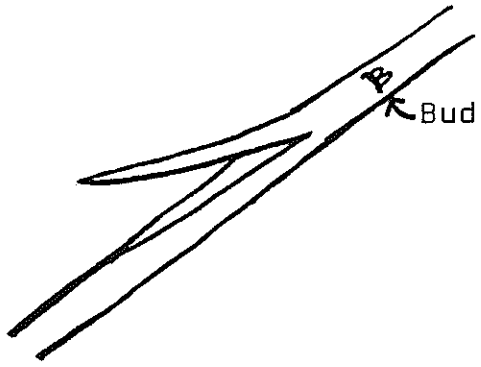
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TEACHERS NOTES:

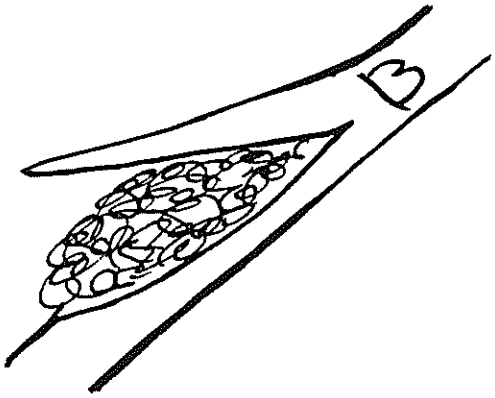
Name _____ Class _____

Plant Propagation

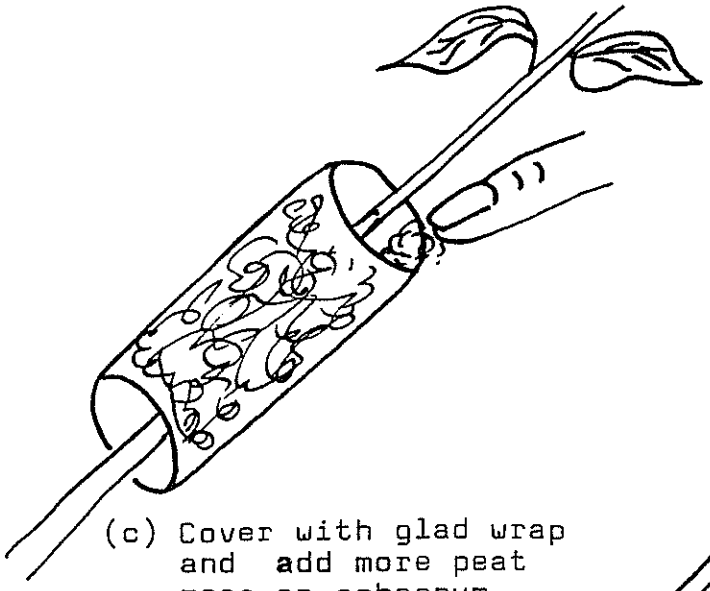
AIR LAYERING (Excellent for all difficult cuttings).



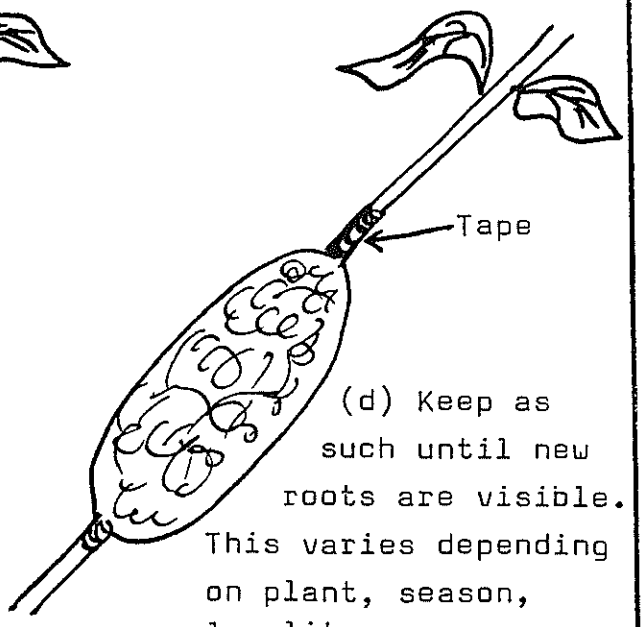
(a) Onto a thick stem, make a single cut, then treat with hormone powder.



(b) Twist in peat moss (moist).



(c) Cover with glad wrap and add more peat moss or sphagnum.



(d) Keep as such until new roots are visible. This varies depending on plant, season, locality.

GRAFTING

Name _____ Class _____

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TEACHERS NOTES:

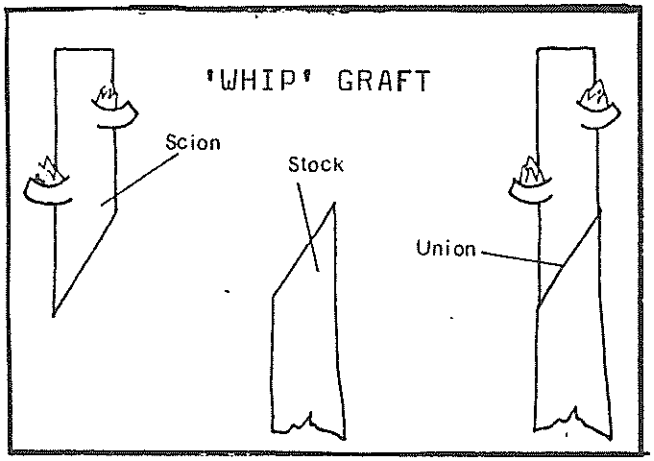
This is the union of scion wood to the rootstock to produce a permanent contact between the two exposed cambium surfaces.

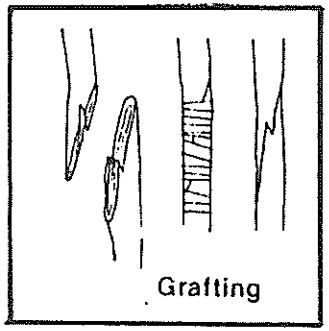
We select a piece of dormant wood, namely a portion of a vigorous shoot grown during the previous season.

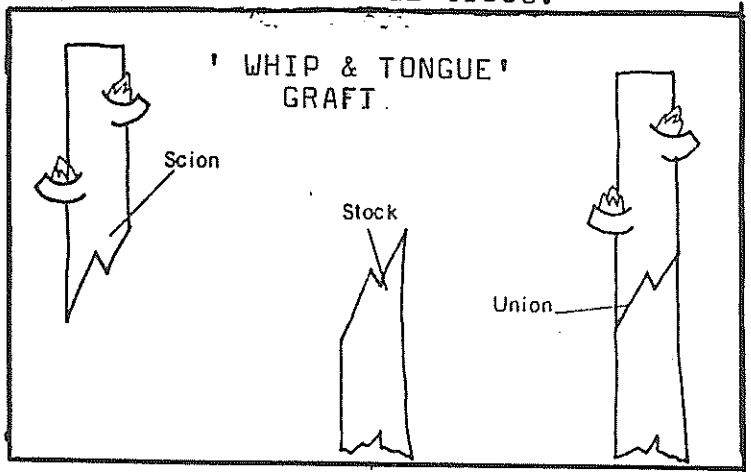
When: Late Winter / Early Spring - at or soon after bud burst.

How : 1. The cutting (scion) and the rootstock are to be of the same thickness.
2. Cut ends depending on the type of graft needed. eg. whip & tongue.
3. Fit together , making sure the inner bark of the scion lines up with that of the rootstock.
4, Bind the union with budding / grafting tape.

Fruit trees are grafted on to rootstock to obtain a vigorous root system and identical trees.







QUESTIONS:

1. What is grafting ? _____
2. When is it performed ? _____
3. Briefly describe the process of grafting . _____
4. Why is grafting practised on fruit trees ? _____
5. List the various methods of grafting . _____

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TEACHERS NOTES:

Name _____ Class _____

BUDDING

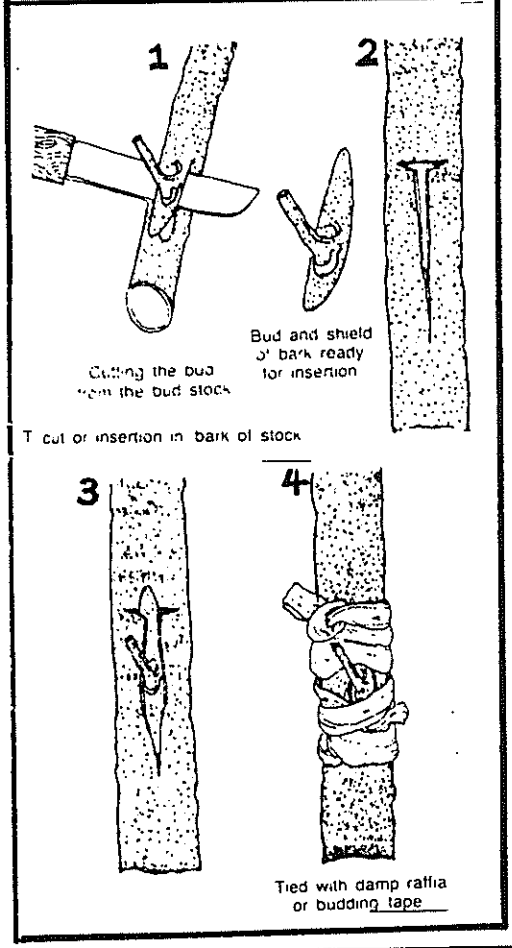
With this operation a single bud of one variety or species is inserted into the wood of another tree of a different variety or species.

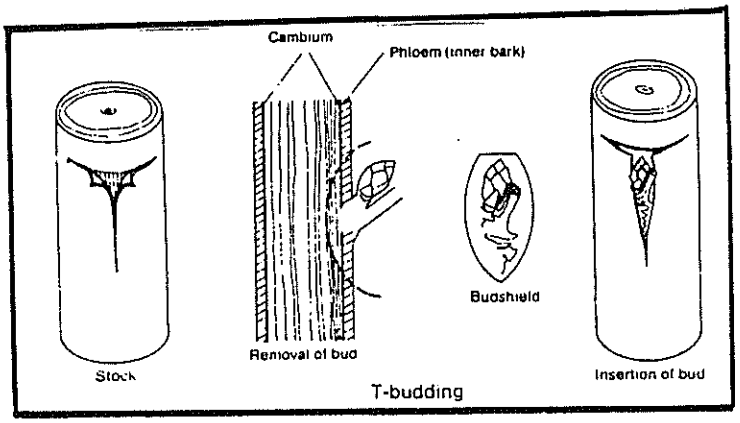
When: Late summer for deciduous and spring or autumn for citrus, when sap is flowing.

Conditions :
1. Species must be compatible.
2. Bark must come away easily from the wood.
3. The two cambium surfaces must meet and be joined quickly.
4. The bud used must be a leaf bud and not a flower bud.

How:
1. Make a T cut (generally used) in one year old wood through the bark - cut should be about 5 cm long & 2-3 cm wide.
2. Raise the bark ready to receive the bud.
3. Insert the bud and tie it firmly into position using budding / grafting tape. (Bud will remain dormant until following Spring.)

Single bud being placed on whole plant.





QUESTIONS:

1. What is budding ? _____

_____

2. When does it occur ? _____

_____

3. Briefly describe the process of budding. _____

_____

_____

_____

_____

AGRICULTURAL WORKSHEET

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TEACHERS NOTES:

Name _____ Class _____

CUTTINGS

Where possible fruit crops are grown from cuttings. Cuttings are taken from established plants using dormant, one year old shoots cut in to lengths of 20 - 40 cm. The method is quick and the new plant will be identical to the parent in its ability to produce.

Dip the basal end into cutting powder (rooting hormone) and it is suggested to dip also into a systemic fungicide eg. Benlate etc. to kill water moulds. When the cutting is planted, the aim is to produce two shoots and a strong root system.

Quinces, pears, figs, grapevines, kiwifruits, some plums and some cherries can be propagated by cuttings.

QUESTIONS :

1. Describe cuttings used for propagation . _____

_____

2. Prior to planting, what other procedure can occur ?

_____

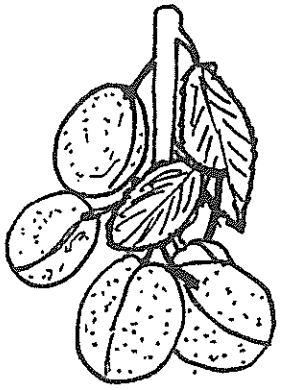
3. What is the aim of using cuttings ? _____

_____

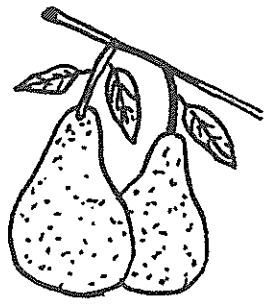
4. What plants (fruit trees) can be propagated by cuttings?

_____

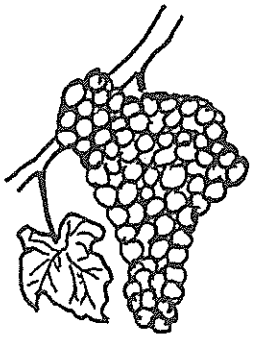
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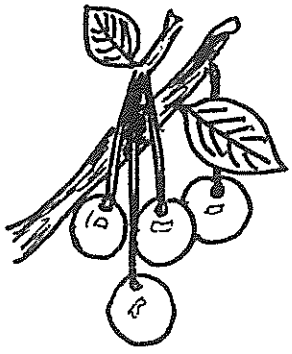
peaches



pears



grapes



cherries

AGRICULTURE WORKSHEET

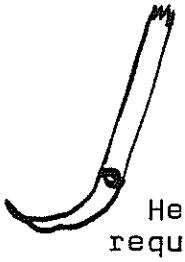
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TEACHERS NOTES:

CUTTINGS

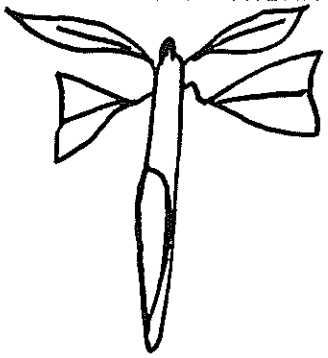
Forms of Cuttings :-

1. STEM (with heel)



Heel often required when taking cuttings eg. Camelia, Conifer.

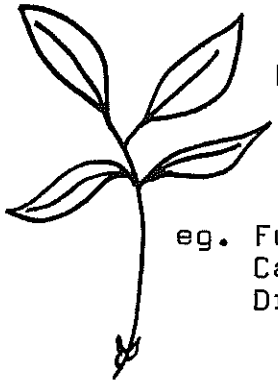
2. STEM TRIMMED



Leaf trimmed; except for ½ terminals.

Useful for Camelias, Azaleas, Rhododendrons.

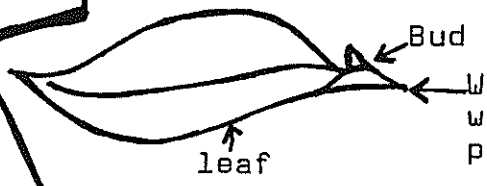
3. TIP CUTTING



Long 50-75 mm softwoods.

eg. Fuschias
Calceolarias
Drowallia.

4. LEAF BUD



Some Cuttings to try:

Chinese Lantern - Usually strike readily at any time.

Aucuba (gold dusts) - Summer → late winter, but use large cuttings 100- 150mm.

Contonecester (C.salicifolia)- Summer → late winter.

Daphne (difficult) - most times of year especially January.
- 75- 100 mm of well ripened wood.
- 6 - 8 weeks strike.

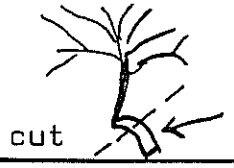
Fuschia - Autumn - 150mm / tips.

Gardenia - better in summer though if kept warm will develop, use 75 mm cuttings.

Hibiscus -NB. only rosa sinensis type or H. syriacus which is deciduous..
The deciduous one use 150- 200 mm long winter cuttings.
H. rosa. sinensis; early autumn - 100 mm long cuttings protect from frost.

Hydrangea- use tip cuttings - best in December - needs warmth.

Conifers: - Pull from parent plant:



Cut heel back, remove lower foliage, insert several into a pot.

AGRICULTURE WORKSHEET

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TEACHERS NOTES:

Table 13 Usual methods of propagating fruit trees

Tree	Rootstock propagated by: Seed	Cutting	Layering	Scion propagated or top worked by: Budding	Grafting	Other
Apple	Snow apple, Crabapple, others	No	In stool beds	Yes	Yes	
Pear	W.R.C. and others *P. calleryana*	Possible	No	Yes	Yes	
Quince	No	Yes	Yes	Yes	Yes	Cuttings or suckers
Peach	Many varieties	Possible	No	Yes	Difficult	Cuttings possible
Almond	As for peach					
Plum	Myrobalan, some others	Yes	No	Yes	One-year-old wood	
Apricot	Many varieties	No	No	Yes	No	
Cherry	Mazzard or Mahaleb	Yes	F 12/1	Yes	Yes (difficult)	
Filbert	Possible	Yes (tip cutting)	Usual (suckers)	Yes (difficult)	Yes (difficult)	Layering suckers
Walnut	*J. regia*, *J. nigra* and other species	No	No	Difficult	Difficult	
Chestnut	Usual	Possible	Possible	Usual	Possible	
Fig	No	Yes	Air-layer	Usual	Possible	Cuttings Suckers
Citrus	Yes	Possible	No	Usual	No	
Grapevine	No	Yes	Possible	Chip-bud	Usual	Cuttings
Passionfruit	Yes	Possible	No	No	Usual	Seed (usual)
Kiwifruit	Yes	Yes	No	Possible	Usual	
Loquat	Yes	On quince	Air-layer	Yes	Possible	Air-layers suckers
Persimmon	Yes	Possible	No	Possible	Yes	
Feijoa	Yes	Yes	No	No	Yes	
Macadamia	Yes	No	No	Possible	Preferred	
Pecan	Yes	No	No	Preferred	Yes	
Olive	Yes	Yes	Yes	Yes	Yes	Horizontal cuttings
Pomegranate	Yes	Yes	Suckers used			Suckers and cuttings

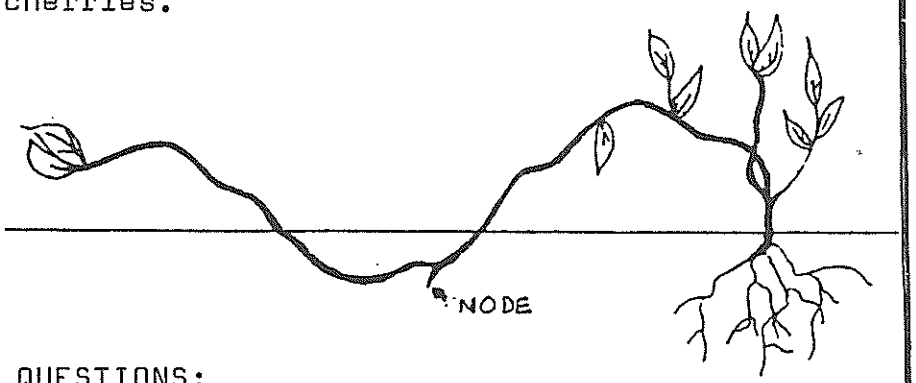
LAYERING

This involves bending a shoot parallel to the soil , making a small cut on the lower side , brush with hormone powder and then pegging it down.

To encourage shoot formation, hill up mulch material around shoots developed from hard pruned trees.

Roots will form where the cut is made (at the node) and the shoot is later detached and replanted, when some aerial growth has also occurred.

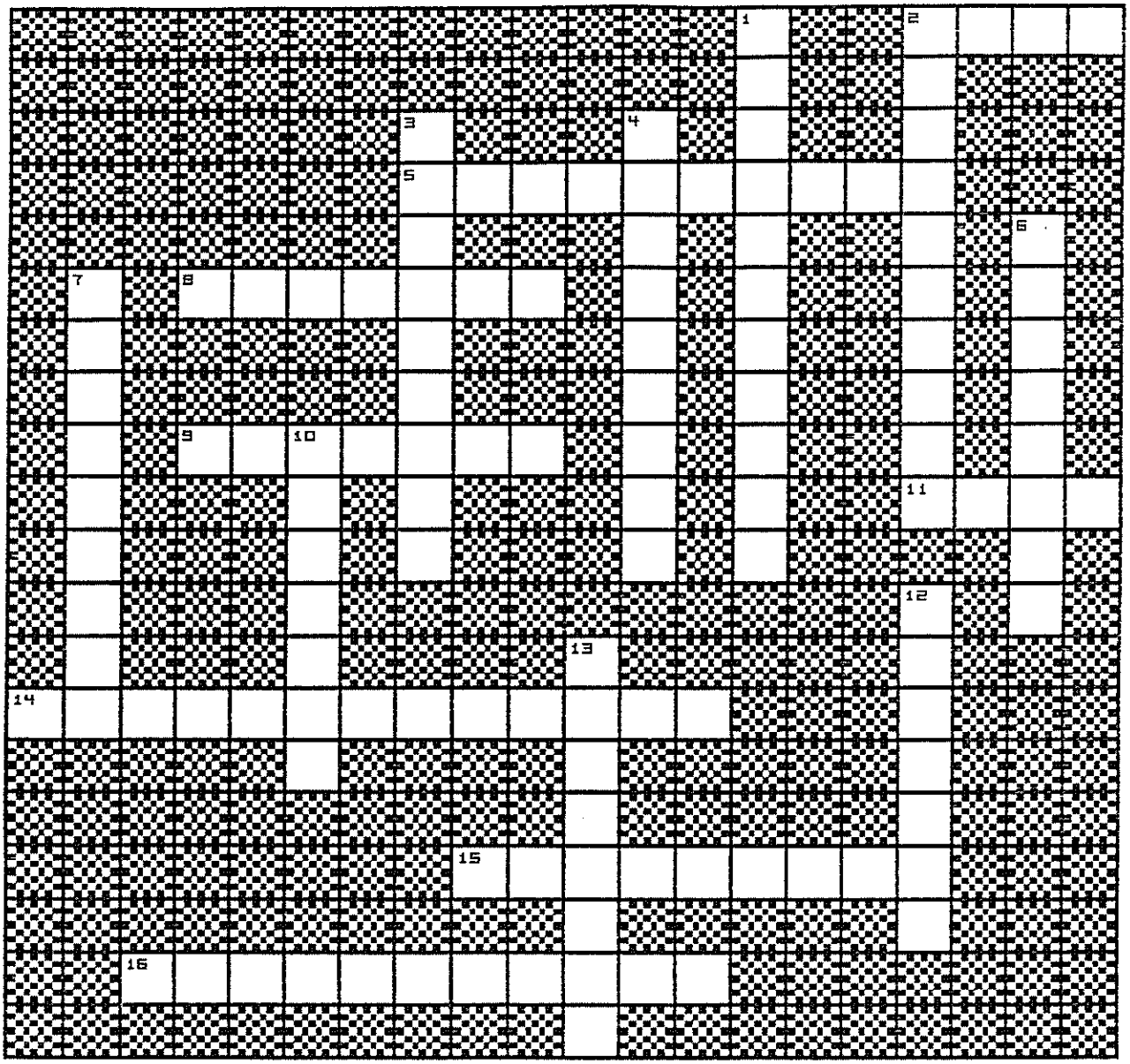
This method is used for apples, plums and cherries.



QUESTIONS:

1. What is layering ? _____
2. For what fruit trees is this method used ? _____
3. Using Table 13, how are the following rootstock propagated ?

CITRUS _____ APRICOTS _____ APPLES _____



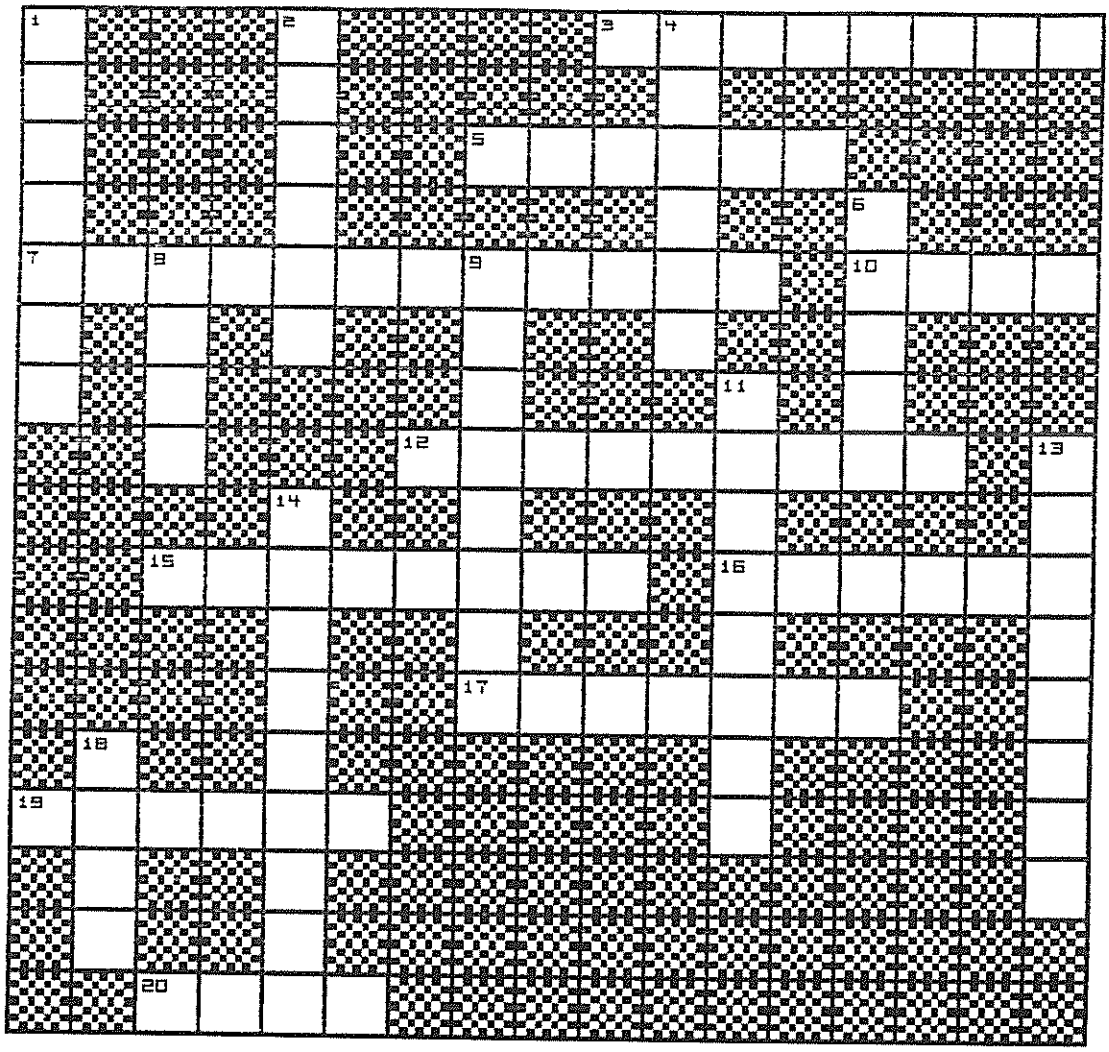
CROSS CLUES

2. A type of frozen rain .
5. A device used to measure wind speed .
8. A tropical storm which produces extremely strong winds .
9. The average weather for an area .
11. The most useful form of precipitation .
14. A scientist who studies weather .
15. A device used to measure rainfall
16. A instrument which continually measures temperatures .

DOWN CLUES

1. The science of studying weather.
2. A instrument for measuring water vapour in the air.
3. An instrument that automatically records air pressure .
4. Two air masses meet and the cold air pushes the wam air upwards .
6. Water vapour in the air is known as _____ .
7. A device orbiting the earth designed to observe weather systems .
10. Lines connecting areas off equal air pressure .
12. The condition of the atmosphere at a particular time .
13. A measure of air pressure .

NATURAL FIBRES



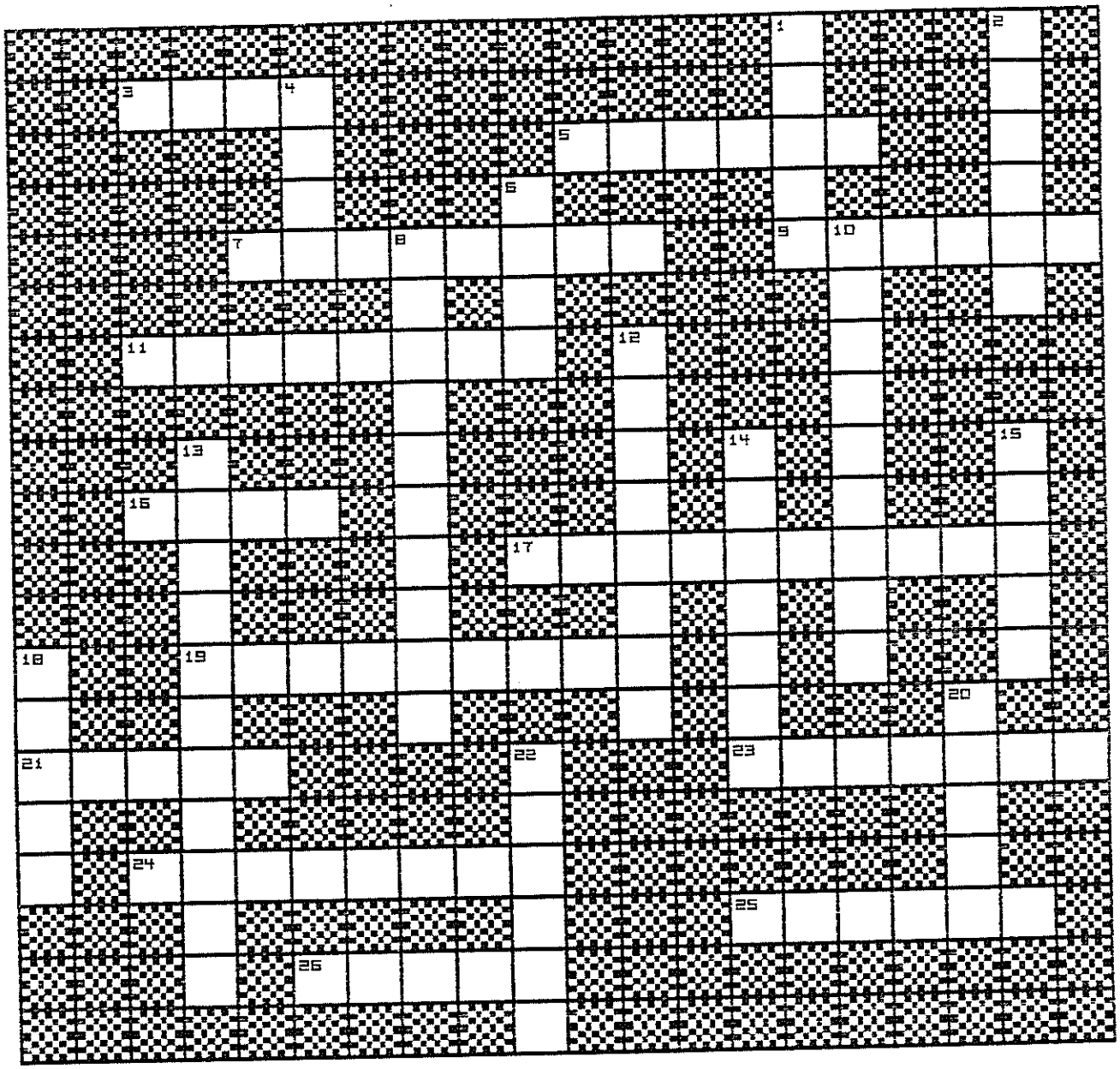
ACROSS CLUES

3. An extremely fine fleece produced by goats
5. A cluster of fibres
7. A term that means flowering
10. Combed and spun fibre
12. The removal of wool from the breech area of sheep
15. The baling of shorn fleeces
16. A breed of fibre producing goat
17. The refining of cotton
19. A fibre produced by angoras
20. A plant fibre

DOWN CLUES

1. The stretching strength of a fibre
2. The measurement for the diamete of a fibre
4. A fibre produced by llama
6. A synthetic fibre
8. A coarse plant fibre
9. The removal of stained fleece
11. The removal of wool
13. The catagorising of wool
14. A spray used to strip plants of leaves
18. The mature ovary of a cotton plant

BEES



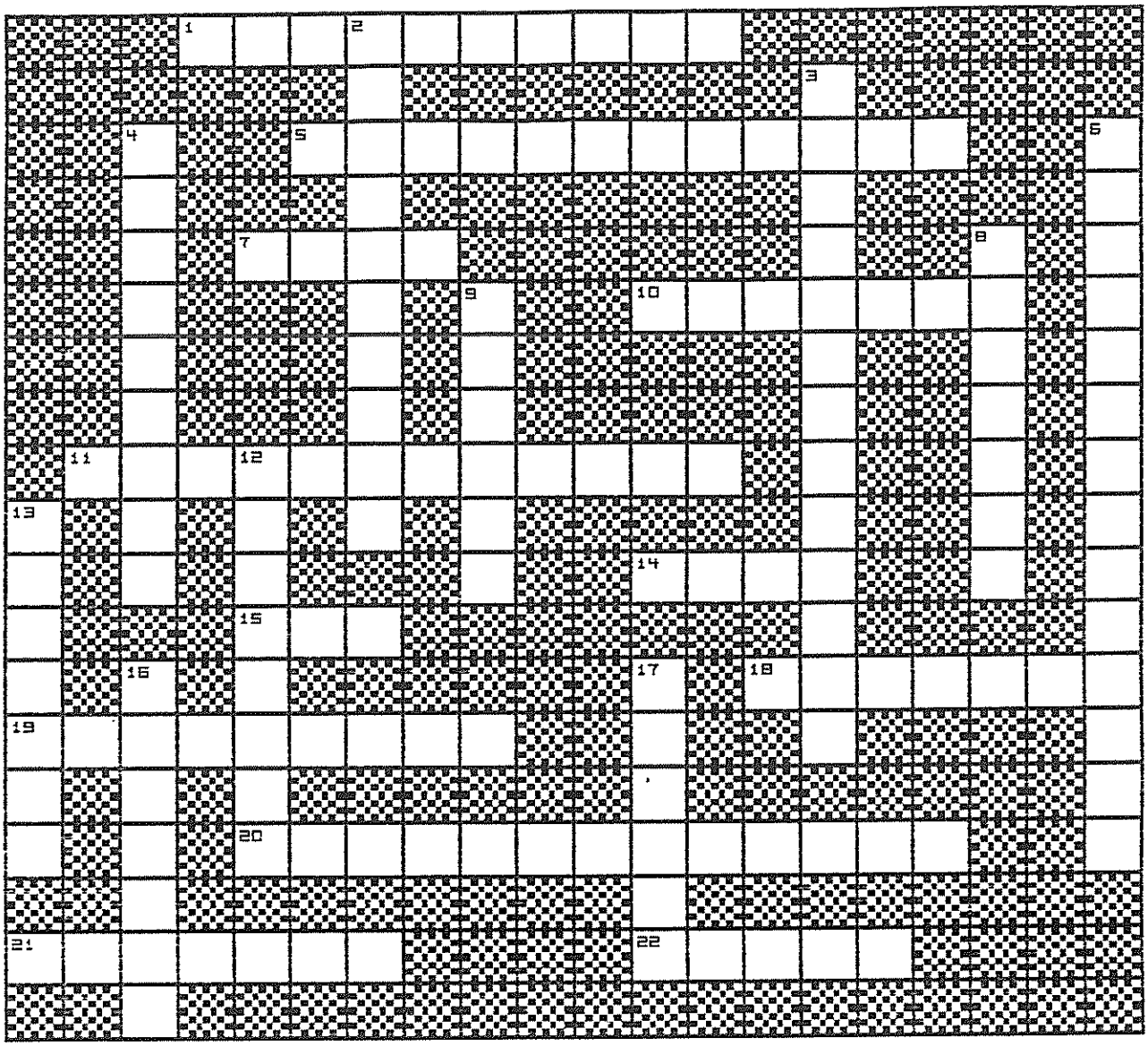
ACROSS CLUES

3. A term used to describe a source of nectar.
5. A infertile female bee .
7. A person who farms bees .
9. A sugary solution produced by plants and converted by bees to honey .
11. A specialised tool used for uncapping the honey frames (2 words).
16. The specialised structures built by bees to hold honey .
17. The wax sheets that are placed in the frames .
19. A special enzyme in a bee's stomach that converts nectar to honey .
21. The stage where metamorphis takes place .
23. The site where the nectar is found in the flower .
24. The tool used to work the hive .
25. A tool used to sedate the bees when working the hive .
26. A male bee .

DOWN CLUES

1. A female bee that is fertile .
2. The grub stage of the bee .
4. An insect enemy of bees .
6. The housing of bees .
8. The rearing of bees .
10. The machine designed to remove honey from the comb .
12. A special grill the stops the queen from getting into the supers .
13. This is achieved by bees when they go from one flower to the next .
14. The largest body segement of bee .
15. The product of bees .
18. The part of the hive where the bees place the honey .
20. A method of bee communication
22. Used by bees for energy .

GROFORESTRY



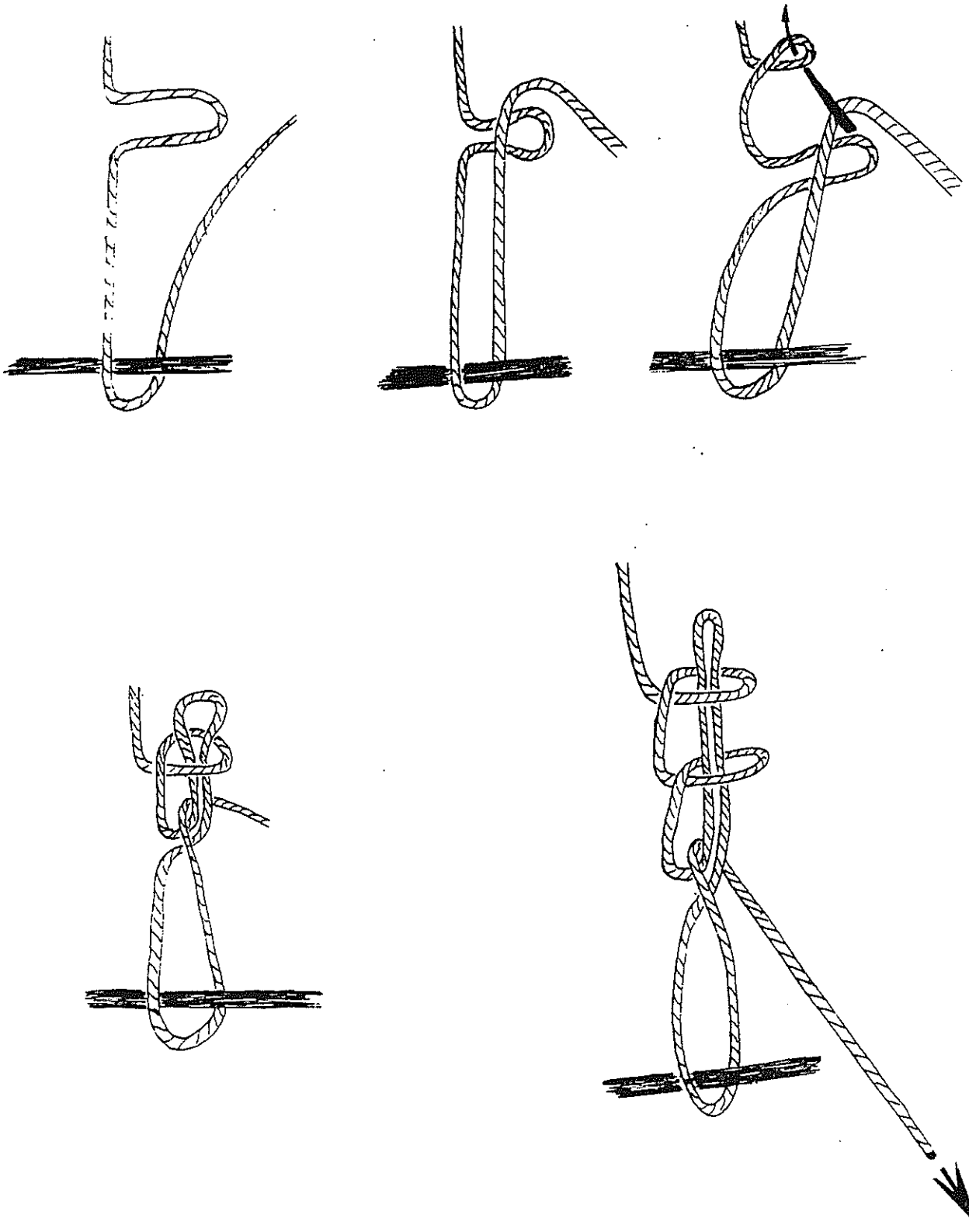
ACROSS CLUES

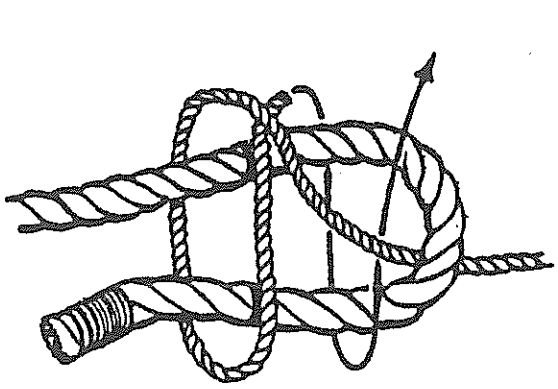
1. A ecualypt used extensively for flooring timber .
5. The term used to describe the combining of forestry and agriculture .
7. The _____ chip industry is associated with the paper industry .
10. The most common cultivated pine .
11. Another term for the regrowth of plant material .
14. The name given to log after its sides are sawn off.
15. The mountain _____ is one of the tallest ecualpt spec es .
18. The regrowth of gums from the butt of the previous adult tree.
19. The name given a system centred around the living and non-living components of an environment .
20. The loss of water from a plants leaves .
21. The scientific name for pines .
22. A name given to decaying plant material .

DOWN CLUES

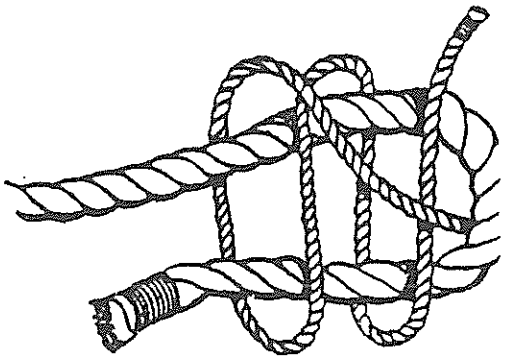
2. An underground root saplings regrow from .
3. Land _____ is achieved by planting trees .
4. The term used to describe the planting of trees in a row to redirect wind .
6. The production of food by plants.
8. This results from the removal of trees and the rising of the water table .
9. A industry that is reliant on trees .
12. The scientific name for gums .
13. A native conifer .
16. The harvesting of trees .
17. An important eucalypt of the forests of Western Australia.

A TRUCKIE'S HITCH



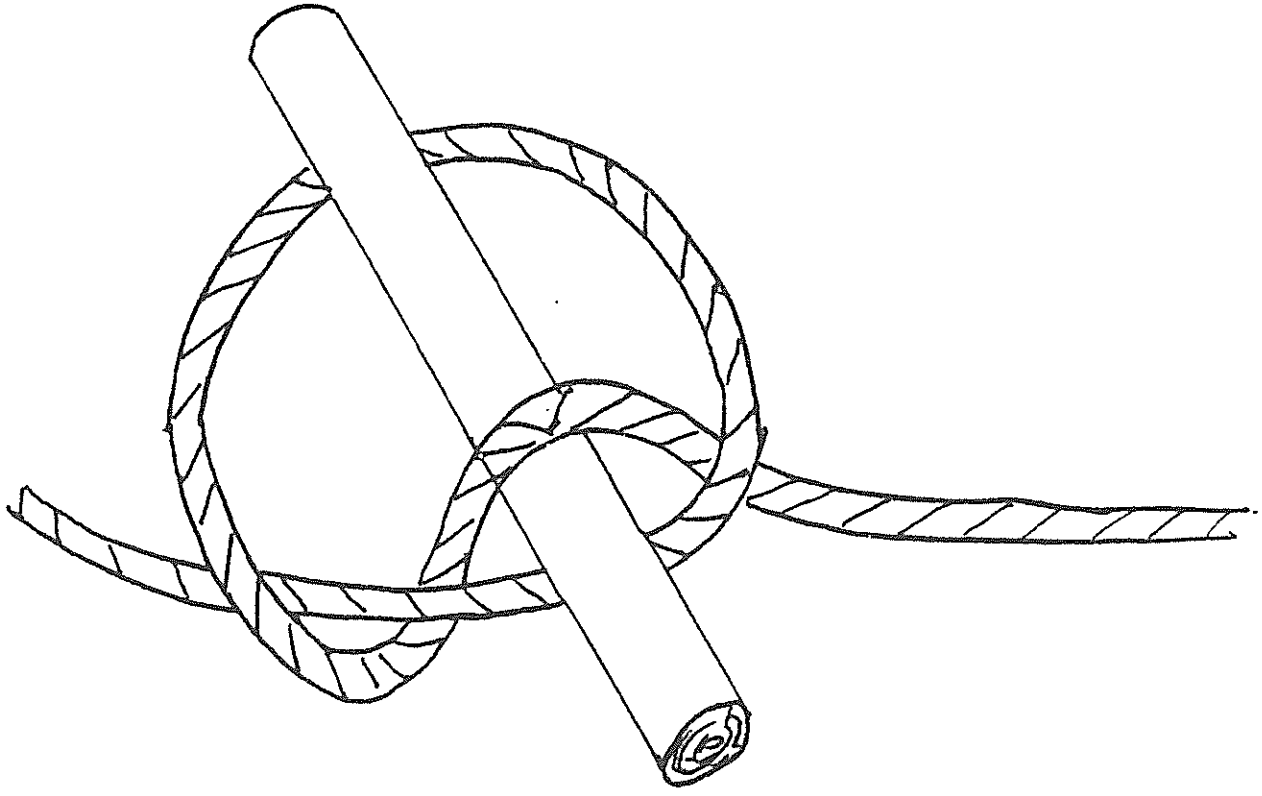


(1)



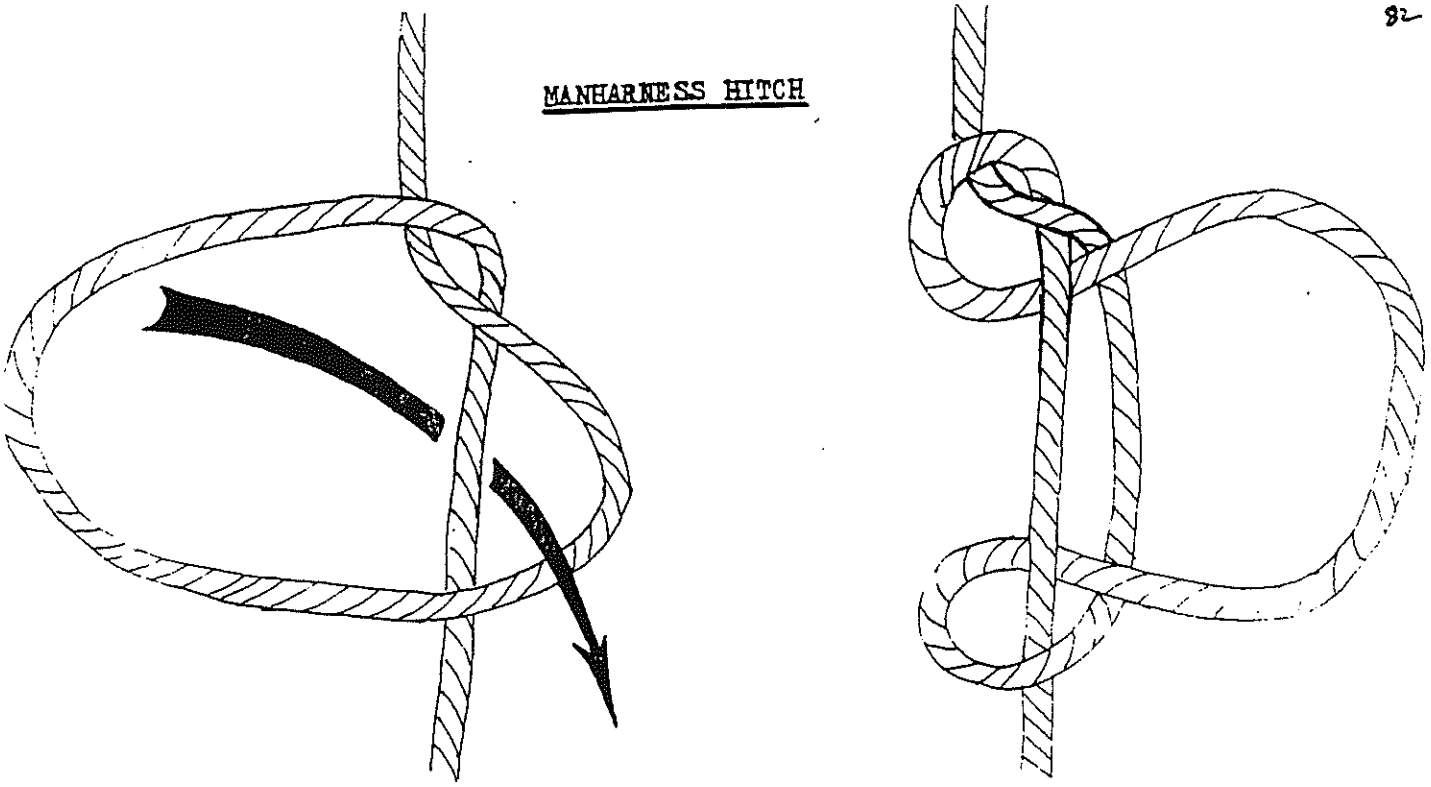
(2)

DOUBLE SHEET BEND



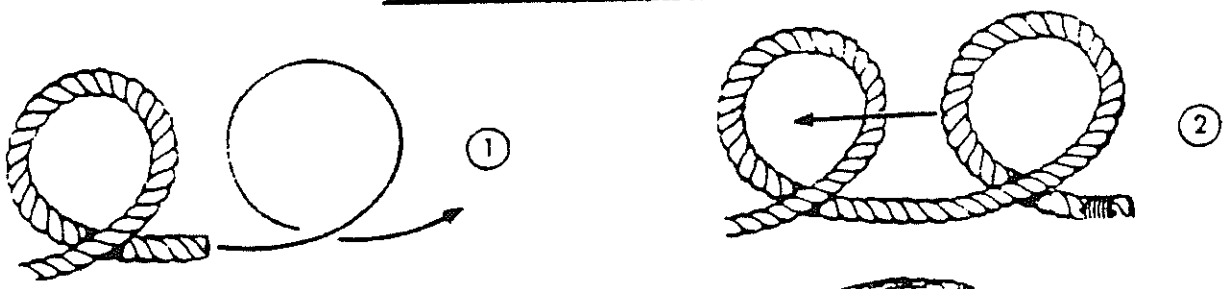
LEVER HITCH

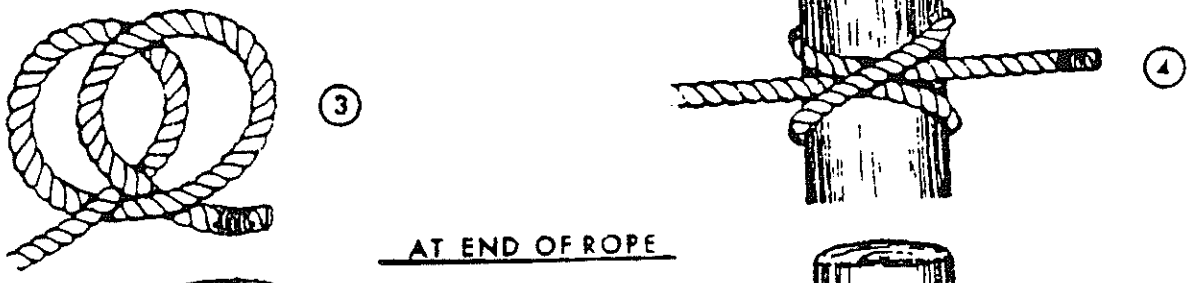
MANHARNESS HITCH



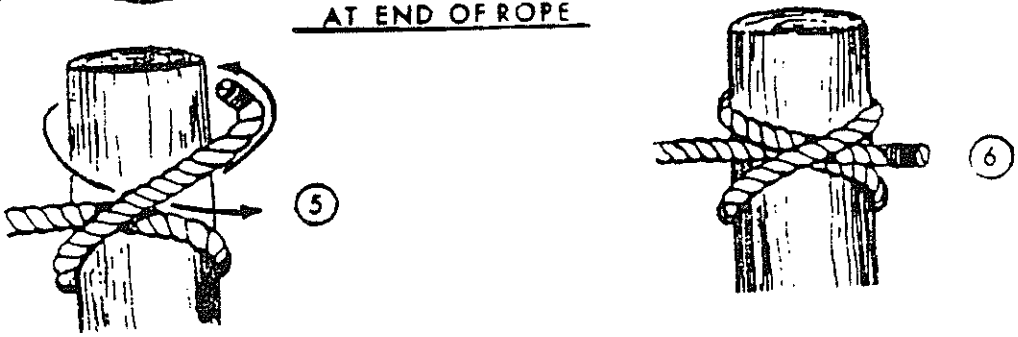
CLOVE HITCH

AT CENTER OF ROPE

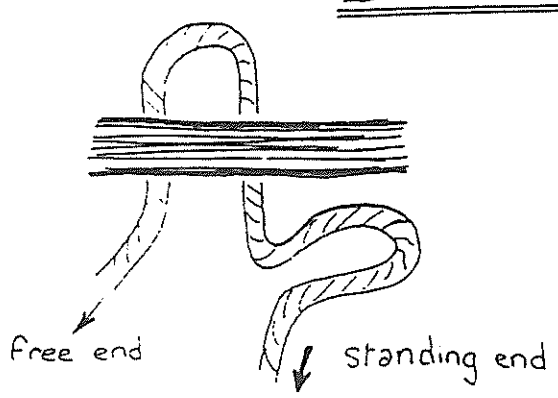


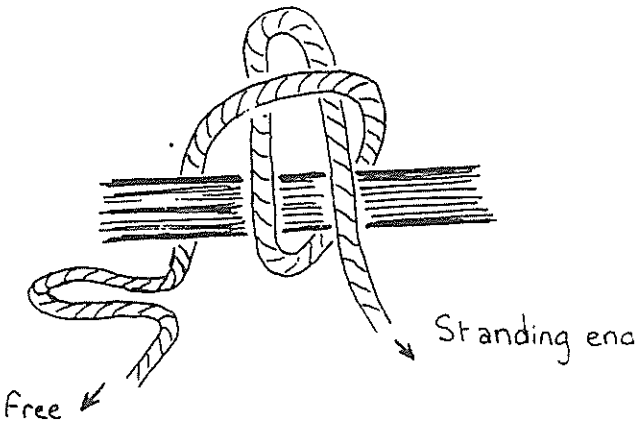


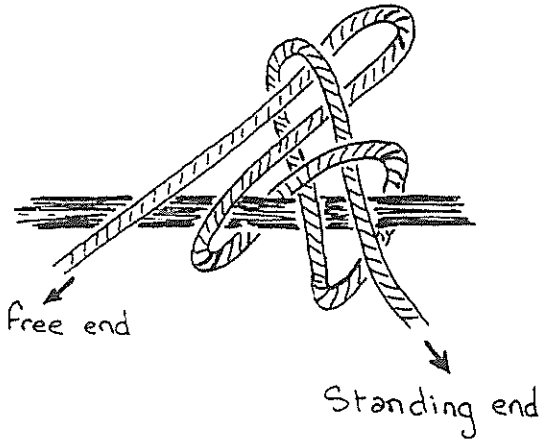
AT END OF ROPE

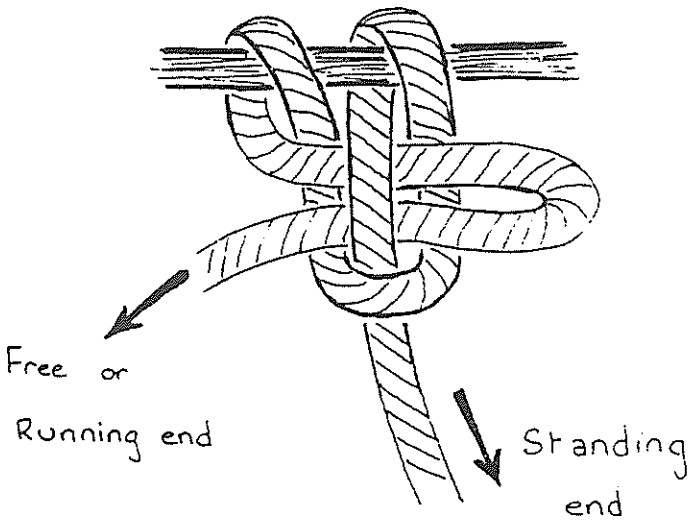


DRAW HITCH

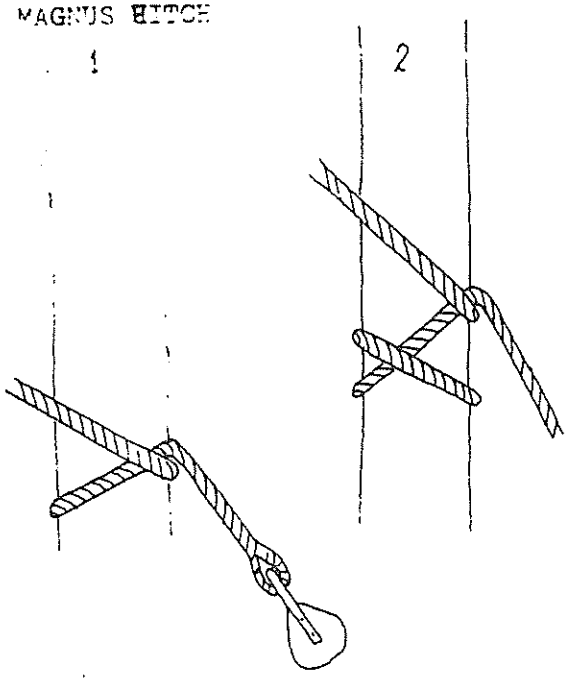


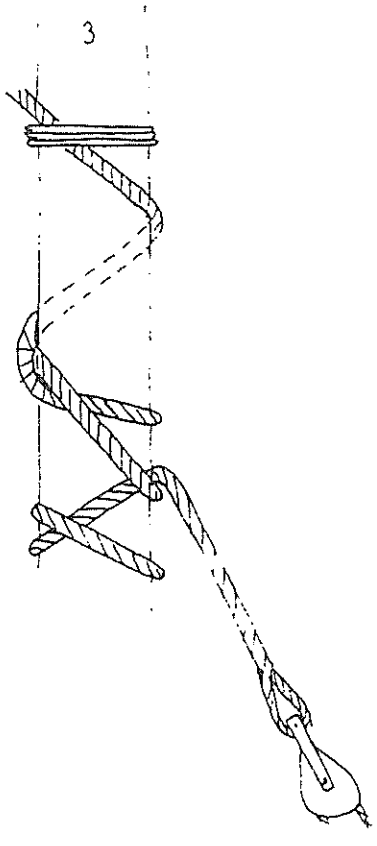




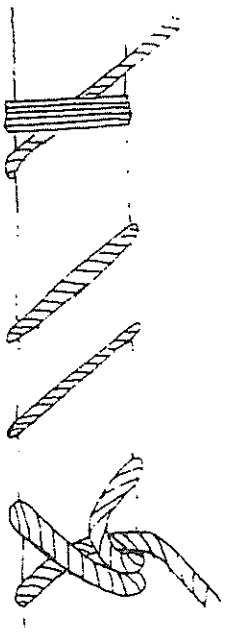


MAGNUS HITCH





STOPPER HITCH



Australian Honey Board

647 GEORGE STREET, SYDNEY, N.S.W. 2000
Telephone: (02) 211 2411 Telex: AA123846
FAX (02) 211 1097

In reply please quote:

PRICE LIST - PROMOTIONAL MATERIAL

1 July 1990

PUBLICATIONS	Each	PRICE Bulk (Incl. Freight)
THE AUSTRALIAN HONEY COOKBOOK (Delicious New Recipes)	2.00	$230 per 200 (1 Ctn) $130 per 100 (1/2 ") $70 per 50 (1/4 ")
THE AUSTRALIAN HONEY RECIPE BOOK (Recipes and Honey information)	1.40	$120 per 200 (1 Ctn) $80 per 100 (1/2 ") $45 per 50 (1/4 ")
HONEY AUSTRALIA'S NATURAL GOLD (12 Colour Illustrated Recipes)	40c	$40 per 100
Peter Russell-Clarke's "HONEY COOKBOOK" (Liberally Illustrated with Cartoons)	5.00	$70 per pack 20
THE WONDERFUL STORY OF AUSTRALIAN HONEY (Educational Booklet in Colour)	80c	$38 per 100 $150 per 400 (1 Ctn)
HONEY - AUSTRALIA'S LIQUID GOLD (Colour Information Booklet)	70c	$34 per 100
POSTERS		
Look What You Can Do With Honey (Size 38cm x 58cm)	2.00	$18 per 10
Australian Honey - Nature's Liquid Gold (Size 62cm x 76cm)	2.00	$18 per 10
Australian Honey - Nature's Health Food (Size 38cm x 58cm)	2.00	$18 per 10
WINDOW BILLS (Size 20cm x 27cm)		
Australian Honey - Nectar of Forest Flowers	20c	$10 per 100
There are more ways with Australian Honey	20c	

WALL CHARTS
(Produced in the UK by the Bee Research Assoc.)

The Honeybee (100x75cm Colour illustrated with descriptions of Queen, Workers, Drones and diagram of life-cycle of each in cell)	20.00	
Bees (100x75cm Colour illustrated with descriptions of solitary, social and advanced social bees)	20.00	
PLASTIC BAGS ("Pure Australian Honey")	12c	$50 per pack 400
PAPER BEES (Fold-up type) 16" Large	6.00	$70 per 12
8" Medium	5.00	$100 per 24
3" Small	2.00	$60 per 36
PIPE CLEANER BEES		
Yellow/Black Small	30c	$3.20 per 12
" " Large	40c	$4.60 per 12
Multi-coloured Large	40c	$4.60 per 12
POSTCARDS - Pack of 8 (Colour - depicting bees at work)	3.50	
BUMPER STICKERS ("Honey- You Do Something for Me")	10c	
DRIP-CUT HONEY DISPENSERS (Yellow Plastic)	2.00	
VIDEO TAPES (Selected VHS Videos - copies produced by the Board)	30.00	

CONDITIONS

1. Prices subject to alteration without notice.
2. Prices of all items include postage and parcel mailing cost within Australia.
3. Where bulk supplies are to be sent via Overnight Road Transport to interstate locations, the price quoted includes delivery to all capital cities only.
4. PAYMENT TO ACCOMPANY ORDER.

APOLLO

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(INCORPORATED IN N.S.W.)

TELEPHONE: (047) 74 8539 FAX: (047) 74 8870

LOT 7, THE NORTHERN ROAD, BRINGELLY, N.S.W. 2171 AUSTRALIA

INTERESTED IN AQUACULTURE?

Greg Williams, proprietor of Apollo Fisheries, runs a commercial enterprise at Bringelly. The predominent species farmed is yabbies although Greg is experimenting with other fresh water fish eg Perch.

Greg is keen to show off his farm to groups of Ag students. A tour includes the outdoor growing tanks, the indoor breeding facilities and the export packaging facilities - the tour takes about 1hour. Work experience can also be arranged. Well worth a visit if you're looking for something different.

Apollo sells live and cooked yabbies - see enclosed price list. Marron are also available from time to time ($40 per breeding pair).

AQUARIUM STOCK		$ 4.50 EACH
BAIT SIZE JUVENILES	(3-5CM)	$ .30 EACH
DAM STOCK JUVENILES	(2-3CM)	$ .20 EACH
BREEDING PAIRS		$20.00 PAIR
40 - 60 GRAMS		$17.00 PER KG
60 - 80 GRAMS		$19.00 PER KG
80 -100 GRAMS		$20.00 PER KG
+100 GRAMS		$23.00 PER KG
TOURS		$ 2.00 PER HEAD

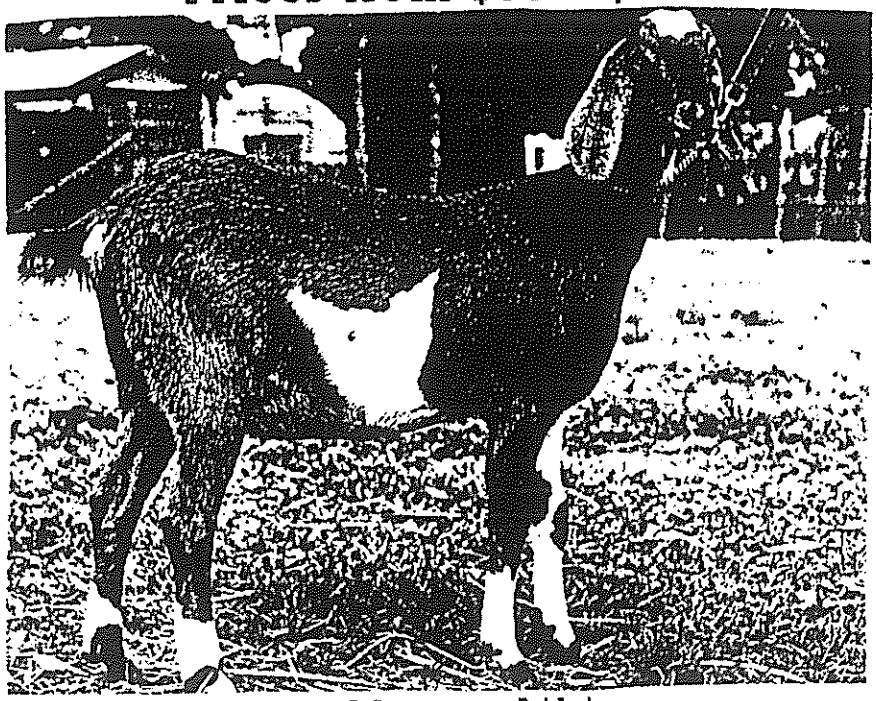
FOR SALE

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