

Industrial technology and design

Hydroponic Vegetable Garden

Unit plan

Acknowledgement to: Aspen Pettersson



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Hydroponic Vegetable Garden

Grade: 10

Suggested Duration: 12 x 70min lessons

Rationale

Hydroponics is the method of growing plants without soil. In nature the soil provides nutrients and is a means of physical support for the plant. In hydroponics, soil is replaced by inert media such as perlite, vermiculite, horticultural rockwool, scoria, sand, or crushed granite, to which the necessary elements for growth are added in the form of a nutrient solution.

People for many centuries have endeavoured to increase yields and improve crop quality against nature's inconsistency. The basic techniques of hydroponics have been known for some time, but it is only since the beginning of this century that the techniques have been refined to the point where they could be applied commercially.

The commercial and hobby production of vegetables and cut flowers hydroponically, is becoming more popular. If optimum growing conditions and nutritional requirements are applied, combined with sound horticultural management, hydroponics can offer an alternative means of food production. Good quality, high yield crops may be produced in areas where climate or location may previously have hampered the production of crops by soil cultivation.

(Crowe, 1984)

This unit of work is designed, not only, to increase student awareness of hydroponics, horticulture and agriculture as areas of interest, educationally, recreationally and possibly commercially, but also to enhance student's ability to link and use a variety of technologies. As well as continue student acquisition of knowledge and understanding into the all areas of Industrial Technology and Design (I.T & D).

Task

In this unit of work students will research, development and construct a working hydroponics garden. Design will be based on their selection of two vegetable types as well as budgetary constraints applied by a component and material price list with a maximum expenditure of \$25.00. In achieving the desired product students will investigate and utilise library resources, the Internet, and product assessment as well as experiment with working models of irrigation systems used in hydroponics. Students are expected to display effective understanding of relevant technologies and plant growth in order to fulfill the desired outcomes. All information and design processes relative to this unit of work is to be recorded in written, pictorial and sketched form within a project folio to be presented with completed product (see project brief, appendix A).

Advanced student activity

All students are expected to complete this unit of work however those students showing greater understanding and implementation, and hence progress at an increased rate, will work on a marketing package to accompany their product.

Aims

Effective teaching of, and study and participation in, this unit of work should continue student understanding of all areas of I.T & D and aim to:

- Help nurture students as life long learners and develop inquiring, creative minds and intellectual skills to assist students ability to interpret, analyse and evaluate information when exploring issues within their built environment, with particular emphasis on innovation and problem solving.
- Enhance student knowledge and understanding of the various aspects pertaining to Industrial Technology and the role it plays within our society and culture.
- Promote student's ability to communicate, verbally and graphically, ideas and concepts within and across the technology, educational and personal arenas.
- Provide equitable insight and work practices within technology, education and society.
- Instill within students understanding and appreciation of health and safety, environmental and ethical issues arising from the use of Industrial Technology.
- Promote the importance and timing of team and individual work.

General Objectives

Through effective teaching and contextual application of this unit of work, students obtain and demonstrate knowledge and understanding in hydroponics and Industrial Technology and Design. Students should acquired and demonstrate their ability in the following four categories:

1) Knowledge and Understanding

Upon completion of this unit of work students should be able to display knowledge and understanding of:

- The development of hydroponics and its impact on the horticulture and agriculture industries as well as society.
- Maintenance of hydroponic systems and sub-systems.
- Advantages and disadvantages of the various hydroponic systems.
- Plant growth and root structures.
- Materials, in terms of their properties and applications, applicable for use in Hydroponics and similar areas.
- Safe use of materials, tools and equipment applicable for use in construction of a hydroponic system.

2) Reasoning

Upon completion of this unit of work students should be able to:

- Make decisions on the appropriateness of materials and processes used in Hydroponics, Horticulture and Agriculture.
- Develop solutions based on given and researched constraints.
- Analyse the impact of Hydroponics on society and the environment and from this make decisions of its importance.

3) Attitudes

Upon completion of this unit of work students should be able to show:

- An understanding of the implications and effects that technology has on the environment, society and culture.
- An understanding of technologies impact on ones quality of life.
- An appreciation of the related areas of Horticulture and Agriculture.

4) Communication

Upon completion of this unit of work students should be able to:

- Use appropriate technical/ scientific and language mediums.

Learning Outcomes/ Experiences

Through participation in this unit of work students will show and gain a depth of knowledge and understanding of the following outcomes/ experiences from the Technology Key Learning Area Syllabus:

1. Technology Practice

Within this unit of work students will:

- Investigate, develop and produce a working hydroponic system via:
 - ✓ Identification of the needs and constraints associated with individual projects.
 - ✓ Production of, and adherence to, designs and plans.
 - ✓ Effective management of time, materials and equipment.

Technology Key Learning Area Outcomes: PP6
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2. Materials

Upon completion of this unit of work students will be able to:

- Select and combine a variety of materials based on the material properties and individual needs.

Specifically:

 - ✓ Poly Vinyl Chloride (PVC): forms, uses, application and joining methods.
 - ✓ Metal: forms, protective coating, cutting and joining methods.
 - ✓ Wood: types, forms, protective coatings and joining methods.
- Utilise available tools, machinery and techniques to optimise personal and classroom safety and increase productivity.

Specifically:

 - ✓ Hand tools: for working with timber, metal and plastic.
 - ✓ Machinery: drill press, jig saw, band saw etc.
 - ✓ Techniques: methods of cutting and joining timber, metal, and PVC.
 - ✓ Safety: equipment and procedures applicable to use with materials, tools, and machinery within the work area.

Technology Key Learning Area Outcomes: MN6 and MT6
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3. Information

Within this unit of work students will:

- Utilise, digest and transform a variety of information sources to assist in design and production as well as the presentation of relevant data in the form of a project folio.

Information will be sourced via:

- ✓ Relevant Internet sites.
- ✓ Publications on hydroponics.
- ✓ A review of available products.

Technology Key Learning Area Outcomes: IT6

4. Systems

Within this unit of work students will:

- Gain understanding, through investigation and experimentation, of a variety of hydroponic systems and associated sub-systems with the intent of implementing, managing and maintaining said systems.

Specifically:

- ✓ Hydroponic systems: associated mediums (soil replacement), nutrients and applications.
- ✓ Irrigation systems: pump and gravity feed systems.

Technology Key Learning Area Outcomes: ST6 and SN6

Assessment

Students are assessed on their understanding of the component learning experiences contained within this unit of work (see learning outcomes and experiences). Student results are given using applicable assessment sheets based on in-class participation, knowledge and understanding and practical application of these. Key areas of evaluation are:

Project folio

- Presentation of folio.
- Design processes recorded in folio.
- Use of relevant research material and mediums to obtain information applicable to this unit of work.

Product

- How well product conforms to chosen design (presented in students project folio).
- Students professionalism, in terms of ability, individualism and safety, in product production and work in a classroom environment.
- Products cost effectiveness based on the following (presented in brief):
 - ✓ Floor space required.
 - ✓ Cost of materials.
 - ✓ Potential crop yield (single crop).

Context

To improve student understanding and knowledge of the task, learning outcomes/ experiences and objectives, including the transfer of knowledge to and from other areas, this unit of work has been placed in a context to which the students can sympathise. The following context has been adopted:

Background

Due to the increasing population in city's, and urban areas, more and more people are moving into flats and townhouse. This kind of accommodation is more affordable and convenient but at a loose of the backyard space provided with a house. One of the options allowed people with access to a yard is the traditional vegetable garden, an option denied to those living in flats and townhouses who only have a small courtyard or veranda at best.

Brief

Design and make a hydroponic vegetable garden suitable for growing two different vegetables within a flat or townhouse setting.

Teaching strategies

Due to the two-fold nature of this unit, that is both theory/ research and practical, a variety of teaching strategies will be utilised to not only suit both situations but also maximise learning as well as maintain student motivation, interest and momentum. Strategies fundamental in obtaining these outcomes are:

- Group work: the use of group work in discussions, brainstorming and questioning to enhance student understanding and knowledge.
- Project approach: use of design brief, initial ideas, idea development, making, testing and evaluation.
- Teaching Functions/explicit: involving a review of prior knowledge, new material introduced with an overview of entire project, use of small steps during any instruction, guiding techniques (prompting, assisting, questions) and feedback.
- Problem solving: use of heuristic approach (that is the recognition of problem, analysis of factors, possible solution, choice of optimal solution, evaluation of results) to solving problems (design, construction and processes) presented within the project.
- Modeling: the use of 2 and 3 dimensional sketching in design phase as well as the use of working models (irrigation systems) for experimentation of ideas.

Resources

As stated above this unit consists of both theory/ research and practical components both requiring different settings and resources:

Table of resources			
type	Setting	Teacher	Student
Theory/ Research	<u>Library</u> <ul style="list-style-type: none"> • Access to computers (1 per student). • Access to Internet. • Video player and TV. • Minimum of the following publications: <ul style="list-style-type: none"> ➢ Fah, J. (2000). Hydroponics made easy. Victoria: Charter Pacific. ➢ Hydroponic Gardening: step by step (1992)(video). N.S.W: Practical Hydroponics Magazine. ➢ Ray, P. (1998). Practical Hydroponics. A step by step guide. Melbourne: Access Hydroponics. ➢ Barry, C. (1996). Nutrients: the handbook to Hydroponic Nutrient Solutions. N.S.W: Casper Publications. 	<ul style="list-style-type: none"> • Hand outs and price lists. • Projection unit for power point presentation. • Videos: 'Little Shop of Horrors' (for intro to unit of work) and 'Cheech and Chong' (for intro to ethics). • Crowe, P. (1984). Hydroponics for schools and home grower. Melbourne: Victorian Schools' Nursery. 	<ul style="list-style-type: none"> • Writing equipment.
Practical	<u>Workshop</u> <ul style="list-style-type: none"> • Hand tools for wood and metal (1 set per student). • Power tools and equipment for work with timber and metal. • Safety equipment relevant to tools and equipment. 	<ul style="list-style-type: none"> • Irrigation kits (for student experimentation). • Materials selected by students. 	<ul style="list-style-type: none"> • Writing equipment. • Safety glasses. • Correct clothing.

Students Prior knowledge

This unit is primarily concerned with introducing students to Hydroponics and the associated learning experiences it provides, however the structure of the unit is based on the student having previous contact with various aspects utilised within it. These aspects consist of:

Materials: students should have a sound knowledge and understanding of timber, metal and plastics, their characteristics and applications.

Tools: students should have high knowledge and understanding of all workshop tools and equipment as well as a sound knowledge of techniques for their use.

Safety: students should have a high knowledge and understanding of safety equipment and practices for all equipment within the workshop environment.

Design: students should have a sound understanding of the design process including investigative techniques.

Technology Key Learning Area Outcomes: the majority of students should have achieved level 5 in all areas with a deepening understanding of level 6 learning areas.

Cross Curricula Links

The processes, learning experiences and outcomes utilised and obtained from this unit of work are not all subject specific to I.T & D. Various subject matter contained within this unit is also relevant to the following curricular areas:

Mathematics: use of measurements and calculation for production procedures and area calculation.

Graphics: use of sketching and working drawings within the design and manufacturing stages.

Science: knowledge and understanding of plant growth, soil, and nutrients.

Overview of lessons

To aid in lesson planning and outcome achievement the following table highlights, briefly, the lessons needed to effectively teach and complete this unit of work.

Hydroponic Vegetable Garden							
week	lesson	Location	Lesson objectives	Teaching Activities	Pupils' activities		Resources
					In class	At home	
1	1	Library	<ul style="list-style-type: none"> • Introduction to hydroponic systems and sub-systems. • Introduction to project: <ul style="list-style-type: none"> ✓ Expectations. ✓ Parts (folio and product). • Research into hydroponics. 	Group activity on introducing hydroponics, using: <ul style="list-style-type: none"> • Brainstorming. • Discussion. • Questioning. Use of information sources for research: <ul style="list-style-type: none"> • Internet sites. • Publications. 	<ul style="list-style-type: none"> • Group discussion on hydroponics systems and sub-systems. • Research hydroponic systems in relation to plant types. 	<ul style="list-style-type: none"> • Decide on vegetables to be use in hydroponic garden. • Investigate hydroponics through specialised shops and nurseries. 	<ul style="list-style-type: none"> • Power point presentation. • Projector and computer. • Video player and TV. • Video 'Little Shop of Horrors'. • Handouts. • Pamphlets. • Internet access.
	2	Library	<ul style="list-style-type: none"> • Introduction to ethics in hydroponics and technology. • Research into hydroponics. 	Group activity on ethical use of technology, using: <ul style="list-style-type: none"> • Brainstorming. • Discussion. • Questioning. Use of information sources for research: <ul style="list-style-type: none"> • Internet sites. • Publications. 	<ul style="list-style-type: none"> • Group discussion on ethical use of hydroponics and technology. • Research hydroponic systems in relation to plant types. 	<ul style="list-style-type: none"> • Decide on vegetables to be use in hydroponic garden. • Investigate hydroponics through specialised shops and nurseries. 	<ul style="list-style-type: none"> • Power point presentation. • Projector and computer. • Video player and TV. • Video 'Cheech and Chong'. • Pamphlets. • Internet access.

week	lesson	Location	Lesson objectives	Teaching Activities	Pupils' activities		Resources
					In class	At home	
2	3	Workshop	<ul style="list-style-type: none"> Investigate and experiment with various irrigation systems. 	<p>Small group activities and micro lessons on irrigation systems, using:</p> <ul style="list-style-type: none"> Experimentation. Working models of irrigation types. 	<p>Experimentation with irrigation kits with Knowledge and understanding obtained in:</p> <ul style="list-style-type: none"> Management. Components. Assemble. Applications. Maintenance. 	<ul style="list-style-type: none"> Investigate hydroponics through specialised shops and nurseries. Work on personal hydroponics designs (record in folio). 	<ul style="list-style-type: none"> Gravity and pump feed Irrigation kits.
	4	Workshop	<ul style="list-style-type: none"> Investigate and experiment with various irrigation systems. 	<p>Small group activities and micro lessons on irrigation systems, using:</p> <ul style="list-style-type: none"> Experimentation. Working models of irrigation types. 	<p>Experimentation with irrigation kits with Knowledge and understanding obtained in:</p> <ul style="list-style-type: none"> Management. Components. Assemble. Applications. Maintenance. 	<ul style="list-style-type: none"> Investigate hydroponics through specialised shops and nurseries. Work on personal hydroponics designs (record in folio). 	<ul style="list-style-type: none"> Gravity and pump feed Irrigation kits.

Week	Lesson	Location	Lesson objectives	Teaching Activities	Pupils' activities		Resources
					In class	At home	
3	5	Library	<ul style="list-style-type: none"> Complete research and finalise designs. Decide on material needs. 	Use of information sources for research: <ul style="list-style-type: none"> Internet sites. Publications. 	<ul style="list-style-type: none"> Research hydroponic systems in relation to plant types. 	<ul style="list-style-type: none"> Finalise designs ready for production (show teacher for approval) 	<ul style="list-style-type: none"> Internet access.
	6	Workshop	<ul style="list-style-type: none"> Commence construction of individual hydroponics projects. Micro lesson on materials and methods of working and joining as required. 	<ul style="list-style-type: none"> Group discussion on PVC. Micro lesson as required by individual or small groups. 	<ul style="list-style-type: none"> Collect pre-selected materials. Work on individual projects. 	<ul style="list-style-type: none"> Continue work on folio, incorporating production procedures. 	<ul style="list-style-type: none"> Selected materials for student projects. Relevant tools and equipment.
4 5 6 7	7 8 9 10 11 12 13 14	Workshop	<ul style="list-style-type: none"> Continue work on individual hydroponics projects. Micro lesson on materials and methods of working and joining as required. 	<ul style="list-style-type: none"> Micro lesson as required by individual or small groups. 	<ul style="list-style-type: none"> Students increase their knowledge and understanding of: <ul style="list-style-type: none"> ➤ Materials. ➤ Tools and equipment. ➤ Techniques. ➤ Terminology. Work on individual projects. 	<ul style="list-style-type: none"> Continue work on folio, incorporating production procedures. 	<ul style="list-style-type: none"> Relevant tools and equipment.

Week	Lesson	location	Lesson objectives	Teaching Activities	Pupils' activities		Resources
					In class	At home	
8	15	Workshop	<ul style="list-style-type: none"> Complete work on individual hydroponics projects. 		<ul style="list-style-type: none"> Self-evaluation of completed project with reflection recorded in folios. 	<ul style="list-style-type: none"> Finalise design folio. 	<ul style="list-style-type: none"> Relevant tools and equipment.
	16	Workshop	<ul style="list-style-type: none"> Student presentation of individual projects. 	<ul style="list-style-type: none"> Group discussion of individual projects. 	<ul style="list-style-type: none"> Presentation of individual hydroponic gardens and folios. 		

Technology education – lesson plan

Hydroponic Vegetable Garden: lesson 1

Teacher name: Gary Johnson	Date: 6 May 2002
Class group: N/A	Year level: 10
Period – start: 9.00 am	Finish: 10.10 am
Period length: 70mins	Room: library (computer access)

Unit objectives

Key learning objectives: Introduction to, understanding and application of hydroponic systems and related sub-systems; understanding and application of associated technologies and relevant materials; understanding of the ethical use of technology in terms of environment, society and culture.

General learning objectives: Knowledge and understanding of hydroponics and associated industries; continued understanding and application of design principles, materials, techniques and tools and equipment; effective utilisation of various information sources; effective use of relevant terminology.

Prior associated learning: Materials (uses and applications), tools/ equipment, safety, techniques of construction and design, understanding of plant growth, soil and nutrients.

Cross-curricular links: Math's, graphics, and science.

Lesson objectives

Lesson objectives: introduction to hydroponics and the unit of work 'Hydroponic Vegetable Garden'; unit requirements and outcomes; student use library resources to research hydroponics.

General objectives: application of research on hydroponic to folio and product construction.

Prior learning: understanding of plant growth, soil and nutrients.

Resources checklist

OHP's	handouts	✓	Chalk board	Special equip.	Special materials
Texts	worksheets	✓	Materials	Power point projector	✓
Models	Projects		others	Video player & TV	✓
Completed demonstration project or drawing for lesson				Yes	No

Special resources: pamphlets on hydroponic systems. Video 'Little Shop of Horrors' for introduction to hydroponics.

Homework/ research: choose vegetables for hydroponic garden, investigate hydroponic through relevant shops and/ or Internet sites, begin work on project folios.

Teaching strategies: student’s interest and momentum to be cultivated through use of group discussion and brainstorming, feedback, 1 on 1 support (where possible) and participation.

Detailed unit procedure

Part	Time	Strategies	Management	resources
introduction	0 – 5mins	<ul style="list-style-type: none"> • 2mins – Bring class inside. • 3mins – mark role. 	<ul style="list-style-type: none"> • Prior to entering students informed of location in library and expectations. 	<ul style="list-style-type: none"> • Role.
Body	60mins +	<ul style="list-style-type: none"> • 5mins – Introduction to Hydroponics through video ‘Little shop of Horrors’. • 30-40mins – discussion and brainstorming on hydroponics using power point presentation (see power point notes attached). • 5mins – brief discussion, using power point, on project task and expectations. • 30-40mins class research time. 	<ul style="list-style-type: none"> • All students participate in power point discussion and brainstorming. • Students to use research time productively. • Teacher available for 1 on 1 consultation. 	<ul style="list-style-type: none"> • pamphlets • power point presentation • handouts
Conclusion	8mins	<ul style="list-style-type: none"> • 5mins – Return or reserve books and/ or log of Internet. • 3mins – brief revision of classwork and homework. 	<ul style="list-style-type: none"> • Students stop work when told. • Students to stand quietly behind desks prior to departure. 	

Advanced students: N/A.

Disruptive students: Separated from class group and provided safety sheets or school code to transcribe.

Attachments/ notes/ sketches: power point presentation and applicable notes.

Technology education – lesson plan

Hydroponic Vegetable Garden: lesson 2

Teacher name: Gary Johnson	Date: 9 May 2002
Class group: N/A	Year level: 10
Period – start: 12.40 pm	Finish: 1.50 pm
Period length: 70mins	Room: library (computer access)

Unit objectives

Key learning objectives: Introduction to, understanding of and application of hydroponic systems and related sub-systems; understanding and application of associated technologies; understanding of the ethical use of technology in terms of environment, society and culture.

General learning objectives: Knowledge and understanding of hydroponics and associated industries; continued understanding and application of design principles, materials, safety, techniques and tools and equipment; effective utilisation of various information sources; effective use of relevant terminology.

Prior associated learning: Materials (uses and applications), tools/ equipment, safety, techniques of construction and design, understanding of plant growth, soil and nutrients.

Cross-curricular links: Math's, graphics, and science.

Lesson objectives

Lesson objectives: introduction to ethical use of hydroponics and technology; continued research by students on hydroponics.

General objectives: Discussion on ethical use of technology.

Prior learning: N/A.

Resources checklist

OHP's	handouts	Chalk board	Special equip.	Special materials
Texts	worksheets	Materials	Power point projector ✓	
Models	Projects	others	Video player & TV ✓	
Completed demonstration project or drawing for lesson			Yes	No

Special resources: pamphlets on hydroponic systems, video 'Cheech and Chong' for introduction to ethics in technology.

Homework/ research: investigate hydroponic through relevant shops and/ or Internet sites, begin work on project folios.

Teaching strategies: student’s interest and momentum to be cultivated through use of group discussion and brainstorming, feedback, 1 on 1 support (where possible) and participation.

Detailed unit procedure

Part	Time	Strategies	Management	resources
introduction	0 – 5mins	<ul style="list-style-type: none"> • 2mins – Bring class inside. • 3mins – mark role. 	<ul style="list-style-type: none"> • Prior to entering students informed of location in library and expectations. 	<ul style="list-style-type: none"> • Role.
Body	60mins +	<ul style="list-style-type: none"> • 5mins – Introduction to ethics using video ‘Cheech and Chong’. • 30-40mins – discussion and brainstorming on ethical use of hydroponics and technology using power point presentation (see power point notes attached). • 30-40mins class research time. 	<ul style="list-style-type: none"> • All students participate in power point discussion and brainstorming. • Students to use research time productively. • Teacher available for 1 on 1 consultation. 	<ul style="list-style-type: none"> • pamphlets • power point presentation
Conclusion	8mins	<ul style="list-style-type: none"> • 5mins – Return or reserve books and/ or log of Internet. • 3mins – brief revision of classwork and homework. 	<ul style="list-style-type: none"> • Students stop work when told. • Students to stand quietly behind desks prior to departure. 	

Advanced students: N/A.

Disruptive students: Separated from class group and provided safety sheets or school code to transcribe.

Attachments/ notes/ sketches: power point presentation and applicable notes.

References

Board of Senior Secondary School Studies (2001). *Industrial Technology and Design Education Subject Area. Syllabus and Guidelines*. The State of Queensland.

Crowe, P. (1984). *Hydroponics for schools and home grower*. Melbourne: Victorian Schools' Nursery.

Queensland School Curriculum Council (2000). *Technology. Year 1 to 10 Syllabus for pilot schools*. The State of Queensland.

Gary Johnson

Design and Technology

Hydroponic Vegetable Garden

Design Brief

Background

Due to the increasing population in city's, and urban areas, more and more people are moving into flats and townhouse. This kind of accommodation is more affordable and convenient but at a loose of the backyard space provided with a house. One of the options allowed people with access to a yard is the traditional vegetable garden, an option denied to those living in flats and townhouses who only have a small courtyard or veranda at best.

Brief

Design and make a hydroponic vegetable garden suitable for growing two different vegetables within a flat or townhouse setting.

Specifications

Your design should:

- Cost no more than \$25.00 to produce, based on price list attached. However you are encouraged to incorporate other materials of your own if you wish.
- Consider factors such as environment of use, safety, ergonomics (human use and size), crop yield, etc.
- Be of a high standard of construction and finish.

Research

Relevant resources are:

- Internet sites.
- Publications (library).
- Product investigation.

Assessment

Theory:

You are required to present a complete 'Design and Planning folio' consisting of relevant information on your design.

Practical:

Marks will be allocated to product functionality (crop yield, cost and size), construction and finish.

Provided material price list

#	Material description	Cost \$	How much you require	Your estimated cost
1	Steel tube: 25mm x 25mm	\$2.50 per M		
2	PVC pipe: 75mm	\$1.50 per M		
3	Pipe Caps: 75mm	\$1.00 each		
4	Plastic Pot – large	\$5.00 each		
5	Plastic Pot – medium	\$4.00 each		
6	Plastic Pot – small	\$3.00 each		
7	Plastic Tray – large	\$7.50 each		
8	Plastic Tray – medium	\$6.00 each		
9	Plastic Bucket – large	\$8.00 each		
10	Plastic Bucket – medium	\$6.50 each		
11	Plastic hose	\$0.50c per M		
12	Plastic Joiners to suit hose	\$0.75c each		
13	Rockwool cubes	\$1.00 each		
14	Small water pump	\$10.00 each		
15	Soil replacement (all same cost)	\$35.00 per M ³		

Provided material subtotal	\$
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Other materials

#	Material description	Cost \$
1		
2		
3		
4		
5		
6		
7		
8		

Other material subtotal	\$
Total	\$