

Agricultural and Horticultural Science NCEA NZC Level 1

Subject Learning Outcomes for Assessment

Companion to the Agricultural and Horticultural Science Learning Matrix

What are the Subject Learning Outcomes and how can I use them?

Subject Learning Outcomes identify the knowledge and skills that students need to be ready for assessment. Subject Learning Outcomes are informed by the Achievement Standards. They should be used in conjunction with the full suite of NCEA materials. For guidance on assessment criteria, please also refer to the Achievement Standards, Unpacking, and External Assessment Specifications or Conditions of Assessment as appropriate.

Subject Learning Outcomes do not replace any documents. This includes the External Assessment Specifications and Conditions of Assessment. All NCEA materials need to be used to fully understand the requirements of each Achievement Standard and to plan a robust teaching, learning, and assessment programme. Subject Learning Outcomes should not be used to make assessor judgments. The Achievement Standard and the Assessment Schedule for Internal Assessment Activities are used to make such judgments.

Subject Learning Outcomes, alongside other key documents, make clear to teachers what to include in their teaching and learning programmes and what student capabilities to check for, in the lead up to assessment. Each Subject Learning Outcome does not need the same amount of teaching time.

All learning should connect with students' lives in Aotearoa New Zealand and the Pacific. Teachers or students usually select the contexts. As such, contexts are not always specified in the Subject Learning Outcomes. Examples may be provided to illustrate topics and contexts, but they are not prescriptive.

Students are entitled to teaching that supports them to achieve higher levels of achievement. Subject Learning Outcomes mainly align with outcomes for the Achieved level. However, outcomes for higher levels of achievement are also included.

The knowledge and skills in the Subject Learning Outcomes are the expected learning that underpins each Achievement Standard. Students will draw on this learning during assessment. It is important to note that assessment is a sampling process so not everything that is taught will be assessed.

Achievement Standard 91928 (1.1)	Demonstrate understanding of how a life process is managed in a primary production system	Credits: 6
What is being assessed:	Specific Learning Outcome (Students are able to....)	
A life process is any of the basic physiological functions of the plant or animal.	<ul style="list-style-type: none">Understand that a life process is any of the basic physiological functions of the plant or animal. Examples of a life process include photosynthesis, nutrition, response to disease.	
Primary production system.	<ul style="list-style-type: none">Describe a primary production system.Explore the interrelationship between primary production and life processes.	
Māori concept	<ul style="list-style-type: none">Demonstrate understanding of a Māori concept in the context of life processes that are managed in a primary production system. Examples of a Māori concept include: tūhononga, manaakitanga, tiakitanga. Other concepts may be explored.	
A management practice is a grower preformed action that is part of production.	<ul style="list-style-type: none">Understand that a management practice is an action that is part of production. Examples of a management practice include fertiliser application, irrigation, drenching, pruning.	
Agricultural Contexts		
Livestock - Digestion and Nutrition. <ul style="list-style-type: none">Livestock nutrition requirements from food.Digestive systems (ruminant and non-ruminant)The nutritional value of feeds.Digestibility of feeds.Feed requirements of maintenance, growth, pregnancy, and lactation.Examples of livestock management practices for digestion and nutrition.<ul style="list-style-type: none">Pasture production<ul style="list-style-type: none">ToppingOversowing new pasture speciesGrazing management e.g., rotational, set stocking, strip,	<ul style="list-style-type: none">Understand digestion and nutrition as a life process.Explore why New Zealand livestock production is pasture based and the national economic significance of this.Describe the influence of the New Zealand climate on pasture or crop production.Discuss pasture as a source of feed for livestock.Describe animal requirements from feed.Name the parts of the ruminant and non-ruminant digestive systems and explain their function.Describe the factors affecting the nutritional value of feeds.Determine why animal feed requirements vary throughout the year.Match feed type to animal requirements, different types of animals, and animals at different stages of physiological growth or production stages.Understand that digestibility of feed affects the uptake of nutrients.Compare or justify feed, or pasture / crop management practices for a given situation.Realise that the choice of feed type influences by digestion and nutrition.Identify the attributes of the main pasture plants of perennial ryegrass and white clover.Explain the complementary growth patterns between white clovers and grasses.Use pasture growth rate and growth curves.	

<p>cells, break feeding, feeding out, zero.</p> <ul style="list-style-type: none"> ▪ Pasture conservation e.g., hay, silage, balage, autumn saved pasture. ○ Crop production <ul style="list-style-type: none"> ▪ Soil conditions e.g., fertilisers, liming, cultivation ▪ Pest and diseases e.g. spraying. ▪ Weeds e.g., spraying. ▪ Irrigation e.g. centre pivot. ▪ Cultivar selection ▪ Seed quality (purity % and germination %). ▪ Crop rotation. 	<ul style="list-style-type: none"> • Justify the use of crops rather than pasture to feed a particular livestock. • Outline the factors affecting pasture and / or crop production and their management practices. • Highlight the plant growth stages throughout the year and link this to changes in nutritional value. • Research management practices used to optimise pasture and / or crop growth from establishment to harvest and explain how they influence pasture or crop growth and utilisation. • Understand the different situations where rotational grazing or set stocking might be chosen. • Recognize how weed control improves production. • Evaluate the need for pasture and crop conservation. • Understand the benefits of crop rotation within a cropping system. • Evaluate how digestion and nutrition is influenced by pasture and crop attributes. • Compare and contrast pasture conservation management practices on digestion and nutrition and the impacts on production. • Rank the importance of the pasture and / or crop production management practices on production.
<p>Livestock – Reproduction.</p> <ul style="list-style-type: none"> • Reproductive systems • Examples of livestock reproduction management practices <ul style="list-style-type: none"> ○ Animal Identification. ○ Oestrus detection methods e.g., tail paint, Kamar, observation. ○ Selective breeding. ○ Artificial breeding. 	<ul style="list-style-type: none"> • Understand reproduction as a life process. • Explain why animal reproduction is important. • Name the organs involved in reproduction and explain their function for both male and female. • Outline the factors influencing reproductive performance e.g., nutrition, mating management, age, health, and genetic ability. • Understand simple Mendelian genetics in terms of being able to discuss hereditary in physical properties and productive traits of animals (chromosomes, genes, alleles, homozygous, heterozygous, recessive, dominant, punnet squares, ratios). • Discuss variation as the basis of selection and explain how it is used in animal breeding programmes to increase farm production. • Explore the role of sex hormones (testosterone, oestrogen) in livestock. • Examine artificial breeding. • Outline the reasons for using identification and the recording of production data. • Compare or justify reproductive management practices for a given situation. • Identify oestrus detention methods. • Evaluate how reproduction is influenced by artificial breeding to improve production. • Compare selective and artificial breeding management practices with their impacts on production.

	<ul style="list-style-type: none"> • Research management practices used to optimise reproduction and explain how they impact on livestock production. • Rank the importance of the reproduction management practices on production.
Livestock – Response to disease. <ul style="list-style-type: none"> • What is health? • The direct and indirect causes of ill health. • Direct causes <ul style="list-style-type: none"> ○ Micro-organisms ○ Parasites ○ Metabolic ○ Nutrient deficiencies ○ Hereditary • Indirect (predisposing causes) e.g., injury, age, hereditary stress, reproduction, nutrition, pregnancy, bad weather, sex. • Identify signs and symptoms of good and poor health - posture, not eating, coat condition, production level, breathing. • Types of ill health. • Examples of response to disease management practices <ul style="list-style-type: none"> ○ level of nutrition, ○ drenching, ○ hygiene, ○ minimise the effects of predisposing causes, ○ vaccinations, ○ breeding, and selection. 	<ul style="list-style-type: none"> • Understand response to disease as a life process. • Discuss the importance of animal health in terms of production, product quality, farmer health, cost, and efficiency of production. • Describe the causes of ill health through direct and indirect causes. • Identify signs and symptoms of good and poor health. • Explain methods used to prevent ill health (level of nutrition, drenching, hygiene, minimise the effects of predisposing causes, vaccinations, breeding, and selection). • Outline the reasons for using vaccinations. • Explain the role of drenching as a response to disease. • Explain breeding and selection as a response to disease. • Evaluate how response to disease is influenced to improve production. • Research management practices used to optimise health and explain how they impact on livestock production. • Compare and contrast management practices used to control parasites with their impacts on production. • Rank the importance of health management practices utilised in a specified production. • Discuss whether controlling direct or indirect causes of ill health is better for overall production of a specified production system. • Compare or justify livestock health management practices for a given situation.
Horticultural Contexts	
Plants – Reproduction.	<ul style="list-style-type: none"> • Understand reproduction as a life process. • Explain why plant reproduction is important for increasing grower returns.

<ul style="list-style-type: none"> • Reproductive systems – Sexual and asexual. • Pollination. • Fertilisation. • Germination. • Seed dormancy. • Examples of management practices for sexual reproduction. <ul style="list-style-type: none"> ○ Breaking dormancy ○ Seed sowing techniques. <ul style="list-style-type: none"> ▪ In pots / seed trays ▪ In plots – open ground ▪ Pricking and thinning out. ▪ Transplanting ▪ Hardening off. • Examples of management practices for asexual reproduction. <ul style="list-style-type: none"> ○ Cuttings. ○ Layering. ○ Grafting and budding. ○ Tissue Culture. ○ Natural forms of asexual reproduction e.g., bulbs, runners, division, etc. 	<ul style="list-style-type: none"> • Name the organs involved in plant reproduction and explain their function. • Understand what is meant by plant propagation. • Identify the differences between sexual and asexual propagation. • Outline the flowering plant lifecycle. • Identify flower structures. • Explain the functions of the main parts of the flower. • Examine the principles of pollination, fertilisation, and embryo formation. • Compare wind versus insect pollinated flowers, and cross and self-pollination. • Recognise that seed formation results in genetic variability. • Define the terms hybrid F1 plants, monohybrid cross, genes, chromosomes, dominant, recessive, phenotype, and genotype. • Identify seed structure and function of the different parts. • Distinguish between the different types of seed dispersal. • Explain the principles of germination. • Outline the factors and conditions necessary or affecting the rate of germination. • Understand simple Mendelian genetics in terms of being able to discuss hereditary in physical properties and productive traits of plants (chromosomes, genes, alleles, homozygous, heterozygous, recessive, dominant, punnet squares, ratios). • Clarify the importance of seed viability. • Investigate what conditions are needed for germination. • Understand plant management practices are influenced by dormancy, germination, pollination, and fertilisation, and seedling emergence. • Explain different ways to break seed dormancy. • Carry out plant management practices for sexual propagation from seed in containers to the open ground, and in sheltered environments. • Recognise that plants can be propagated using asexual means. • Identify the different types of cuttings and their relative position on the plant. • Apply cutting techniques to specific plants. • State the specific plants that can be grown using layering. • Understand the use of grafting and budding principles and practices. • Research management practices used to optimise propagation and explain how they improve plant production. • Compare and contrast sexual and asexual propagation management practices.
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	<ul style="list-style-type: none"> • Justify reproductive management practices for a given situation.
<p>Plants – Growth, Respiration, Photosynthesis, Nutrient Uptake, or Transpiration.</p> <ul style="list-style-type: none"> • Plant parts and their functions. • Plant processes - growth, respiration, photosynthesis, nutrient uptake, transpiration. • Examples of plant management practices for growth, transpiration, nutrient uptake, photosynthesis, and respiration. <ul style="list-style-type: none"> ○ Irrigation ○ Providing shelter ○ Cultivation ○ Training ○ Nutrient application ○ Pest, disease and weed control. 	<ul style="list-style-type: none"> • Understand growth, respiration, photosynthesis, nutrient uptake, and transpiration as life processes. • Explain why these plant processes are important. • Identify and label the external and internal parts of a plant. • Research the function of plant parts. • View plant cells under a microscope. • Compare the volume of roots and shoots for a range of weeds using water displacement. • Describe the environmental factors that influence plant growth. • Name the raw materials of photosynthesis and identify where they are from. • State the chemical equations for photosynthesis and respiration in words and symbols. • Relate the photosynthesis equation to the production of seeds and fruit. • Investigate the impact light has on photosynthesis. • Research management practices used to optimise photosynthesis. • Explain the role of pest and disease control. • Draw up a plan for crop rotations on an area of land. • Recognise the benefits to plants of applying lime to soil. • Compare natural and artificial shelter. • Recognise the need for protective structures and the impact these have on plant processes. • Classify fertiliser by its type. • Explain how training plants impact plant processes. • Use a key to identify mineral deficiencies in plants. • Carry out training techniques such as pruning, staking, and tying. • Describe the detrimental effects of weeds on plant growth. • Evaluate the effectiveness of different pest and disease controls. • Draw a chart showing which plant management practices effect which life processes and how plant growth is impacted. • Compare and contrast management practices that effect the life process to improve production. • Compare or justify management practices for a particular life process to improve production.

Achievement Standard 91929 (1.2)	Demonstrate understanding of factors that influence the purpose and location of primary production	Credits: 5
What is being assessed	Specific Learning Outcome (Students are able to....)	
Purpose of primary production is a social, cultural, environmental, historical, or economic goal or reason for the establishment of a production system.	<ul style="list-style-type: none"> • Explain why the purpose and location of production is important to New Zealand. • Understand that the purpose is influenced by interrelated economic, social, cultural, sustainable, historical, and environmental reasons. • Investigate the contribution agricultural and horticultural production makes to Aotearoa New Zealand export earnings. 	
Location is the geographical area or region where the primary product is produced.	<ul style="list-style-type: none"> • Identify the physical factors of the environment that must be considered to produce a product. • Discuss why most of New Zealand's towns and cities are located near waterways. • Examine Māori and European settlement patterns and their relationship to food production and / or harvest. • Determine the distribution of products produced in a region or area. 	
Factors are the conditions that can influence the purpose and location of primary production. These could be: 1. Physical (soil, topography) 2. Climatic (temperature, precipitation, wind) 3. Market (availability of labour, access to processing plants)	<ul style="list-style-type: none"> • Examine the physical factors that impact on primary production. • Explore soil types across New Zealand and their impact on primary production. • Determine the range of climatic factors that impact on primary production. • Understand why climatic factors determine location of products grown. • Compare climatic information of the regions – sunshine, precipitation, temperature, wind. • Carry out field measurements from a range of environments around the school (open ground, tunnel house, shelter belt, etc) or collect this from the newspaper, and collate the data in a table. • Measure air temperature, soil temperature, light intensity, wind speed, rainfall, and humidity. • Examine the distance to market (endpoint) for a locally produced product. • Explore how many people are required in different primary industries such as beef, avocados, and dairy. • Inquire how many processing plants there are for a product, such as dairy, apples, poultry, or sheep. • Research career pathways opportunities directly related to the primary industries in New Zealand. • Investigate some production systems that could be started or developed in your local area taking into consideration climatic and physical factors that enable or limit production. • List the factors which have led to the growing of a product in the local area and evaluate their relative importance. • Using the contributing factors, evaluate the purpose and location of a primary production. 	

Achievement Standard 91930 (1.3)	Demonstrate understanding of how soil properties are managed in a primary production system	Credits: 5
What is being assessed:	Specific Learning Outcome (Students are able to....)	
Primary production system.	<ul style="list-style-type: none"> Describe a primary production system. Explore the interrelationship between primary production and soil properties. 	
Māori concept	<ul style="list-style-type: none"> Demonstrate understanding of a Māori concept in the context of soil properties that are managed in a primary production system. Examples of a Māori concept include: tūhononga, manaakitanga, tiakitanga. Other appropriate ones can be used. 	
Importance of soils as a growing medium <ul style="list-style-type: none"> Describe why plants need a growing medium. 	<ul style="list-style-type: none"> Understand why plants need a growing medium. Explain why soil is important to the primary industry. Understand the nature of soil as a variable mixture, subject to change, and provides nutrients, minerals, air, and water to plants and soil organisms. Make links between plant growth and soils. 	
Soil Composition. <ul style="list-style-type: none"> Mineral matter (sand, silt, and clay) Organic matter Soil organisms (earthworms and micro-organisms) Air Water 	<ul style="list-style-type: none"> Describe soil composition and components. Understand what makes up soil, that it is a mixture containing nutrients, minerals, organic matter, air, water, and living organisms. 	
Soil Texture <ul style="list-style-type: none"> Simple knowledge of texture - proportions of sand, silt, and clay 	<ul style="list-style-type: none"> Determine texture of a soil. Compare different soils and their textures. Understand soil structure in terms of particle size and pore structure. Determine the proportions of sand, silt, and clay in a soil. 	
How soil is made? Soil Profile Soil Horizons	<ul style="list-style-type: none"> Understand the formation of soil. Explain how soil variations affect plant growth. Distinguish soil profiles and horizons. 	
Physical Properties of Soil <ul style="list-style-type: none"> Soil Structure - refers to the way soil particles are grouped together. Soil texture – refers to the proportions of sand, silt, and clay. Drainage and aeration 	<ul style="list-style-type: none"> Distinguish between physical, chemical, and biological properties of soil. Use a soil texture triangle to determine textural names / soil types. Explain the physical properties of soil. Understand the properties of different soil types. Apply knowledge of soil structure. Understand the movement of air through soil. 	

<ul style="list-style-type: none"> • Aeration • Water holding capacity. • Temperature 	<ul style="list-style-type: none"> • Recognise movement of water through soil and its permeability. • Use the terms field capacity, saturation, permanent wilting point. • Consider soil temperature and its effects. • Compare the amount of air found in different soil structures / types.
<p>Chemical Properties of Soil</p> <ul style="list-style-type: none"> • Soil pH • Soil as a Reservoir and a Source of Nutrients • Macro and Micronutrients. 	<ul style="list-style-type: none"> • Describe the chemical properties of soil. • Understand soil pH and its impact on soil structure, nutrient availability and biological activity. • Compare macro and micronutrients. • Understand what affects nutrient status of soil.
<p>Biological Properties of Soil</p> <p>1) Organic Matter</p> <ul style="list-style-type: none"> • Organic matter and its decomposition to humus <p>2) Soil Organisms</p> <ul style="list-style-type: none"> • Macro-organisms – earthworms. • Micro-organisms – fungi and bacteria. • Symbiotic associations, soil pathogens, and soil pests. 	<ul style="list-style-type: none"> • Describe the biological properties of soil. • Link the value of organic matter and its decomposition into humus, to physical and chemical benefits to the soil. • Explain the role of soil organisms. • Recognize the difference between beneficial and pathogenic organisms. • Understand the role of symbiotic associations, soil pathogens, and soil pests. • Explain the difference between macro-organisms and microorganisms. • Outline why nitrogen fixing bacteria are important. • Explain how crop rotation helps with the control of soil pests.
<p>Examples of modification of soils using management practices.</p> <p>Modification by physical means</p> <ul style="list-style-type: none"> • Cultivation - mechanical breaking up and turning of the soil. • Drainage. • Irrigation. 	<ul style="list-style-type: none"> • Describe the methods used to modify soil properties so that it becomes a medium suitable for growing plants. • Explore how and why primary production management practices are carried out as they are. • Recognise the need for cultivation. • Understand the purpose of cultivation and the effects of overcultivation. • Apply different cultivation methods - digging (single and double), raking, hoeing, rotary hoeing, minimum tillage, and no-dig. • Use basic garden tools commonly used in modern gardens. • Discuss garden tools of the pre-European Māori. • Communicate the different types of drains – surface, and subsurface. • Use the terms water availability, evapotranspiration. • Estimate crop water requirements. • Understand the types of irrigation and drainage systems. • Choose an appropriate irrigation or drainage system.
<p>Modification by adding organic material.</p>	<ul style="list-style-type: none"> • Understand the organic matter addition methods used to modify or improve soil.

<ul style="list-style-type: none"> • Mulches • Composting. • Green Manure Crops. • Effluent. 	<ul style="list-style-type: none"> • Carry out mulching. • Determine the differences between the different types of mulch – green, organic, and inorganic. • Outline the effects of mulching. • Understand what composting is. • Explain the principles of composting and its value in improving soil conditions. • Identify what green manure crops are. • Explain the principles of green manure crops and their value in improving soil conditions.
Modification by adding lime.	<ul style="list-style-type: none"> • Understand what happens to the soil when lime is added.
Modification by adding nutrients. <ul style="list-style-type: none"> • Essential Nutrients • NPK ratios. • Nutrient Deficiencies. • Loss of nutrients • Providing Plant Nutrients. • Crop Rotations (Pest Control, Nitrogen cycle and Interplanting) • Fertiliser Application. • Effluent Application 	<ul style="list-style-type: none"> • Recognise the nutrient requirements of plants. • Distinguish between the major nutrients N, P, K, S, Mg, Ca and trace elements Mo, Cu, Fe, Zn, B and understand plant requirements of these. • Understand the significance of the NPKS ratio of fertilisers. • Explain how plants take up essential elements / nutrients. • State the importance of nutrients in plant health. • Describe common nutrient deficiencies and their symptoms. • Describe how nutrients are lost by leaching, plant growth and harvesting. • Explore a range of methods to provide plant nutrients. • Apply fertilisers in a range of methods. • Describe how to apply fertilisers and understand the best practices for fertiliser use. • Explore out crop rotations. • Explain the role of the nitrogen cycle in primary production. • Explain the different methods of effluent applications.
Bringing it all together.	<ul style="list-style-type: none"> • Compare and contrast management practices used to manage soil properties to optimise production. • Rank the importance of soil management practices utilised in a specified production. • Compare or justify soil management practices for a given situation. • Evaluate which soil management practices are most effective at optimising production.

Achievement Standard 91931 (1.4)	Demonstrate understanding of environmental sustainability in primary production management practices	Credits: 4
What is being assessed:	Specific Learning Outcome (Students are able to....)	
Importance of Primary Production in New Zealand.	<ul style="list-style-type: none"> Understand why the environmental impact of primary production is important for all New Zealanders. 	
Environmental Sustainability. <ul style="list-style-type: none"> The implications of primary production management practices on environmental sustainability are positive and / or negative impacts. What is an environmental impact? 	<ul style="list-style-type: none"> Understand that environmental sustainability is the ability to maintain an ecological balance in the environment and conserve natural resources to support the wellbeing of current and future generations. State what the environment is. Appreciate that management practices can have impacts on the environment and the wider community. Explore how management practices used in the production of crops and livestock can impact the wider community. Identify primary production management practices that impact on the environment. 	
Positive implications of environmental sustainability.	<ul style="list-style-type: none"> Identify primary production management practices that have a positive impact on the environment. Explain the positive impacts of management practices on the environment. Explore the specific positive impacts of management practices from the production of a crop or livestock on the environment (air, water, soil/land, living organisms) and link the management practice to the positive environmental impact. List words or phrases that distinguish sustainable management practices. Visit an orchard or farm to look at sustainable practices. 	
Negative implications of environmental sustainability.	<ul style="list-style-type: none"> Identify primary production management practices that have a negative impact on the environment. Explain negative impacts of management practices on the environment. Explore the specific negative impacts of management practices from the production of a crop or livestock on the environment (air, water, soil/land, living organisms) and pose solutions to these problems. Differentiate between positive and negative impacts on the environment. 	
Impacts on soil, water, atmosphere, and living things.	<ul style="list-style-type: none"> Communicate how environmental impacts may affect living things, and the quality of the atmosphere, water, or soil. Critically analyse the consequences of a selected primary production such as forestry or horticulture on fresh water. Investigate indigenous indicators of health of the waterway. 	

	<ul style="list-style-type: none"> Consider a local (New Zealand or Pacific) / relevant primary production and organise the class into groups to construct arguments around different viewpoints/perspectives of its environmental impact. Critically analyse the consequences of the impacts of producing crops, or livestock on people, other living things, and the physical environment.
<p>Examples of management practices.</p> <ul style="list-style-type: none"> Riparian planting Erosion control Cultivation and minimum tillage Use of agrichemicals Fencing waterways Irrigation Nutrient application and management Effluent application and management. Pest control. Grazing management. 	<ul style="list-style-type: none"> Identify management practices that can be used to manage growing environments. Communicate how nutrients are lost by leaching, plant growth and harvesting. Differentiate the methods of effluent applications. Explain the principles of green manure crops and their value in improving soil conditions. Choose an appropriate irrigation or drainage system for a particular land type and use. Link the value of organic matter and its decomposition into humus, to physical and chemical benefits to the soil. Understand the purpose of cultivation and the effects of overcultivation. Recognise movement of water through soil and its permeability and the management practices that can be used to increase or decrease this movement. Investigate different techniques of management practices to reduce environmental impacts and to increase environmental sustainability. Understand how producers use management practices to reduce impacts on the environment.
Bringing it all together.	<ul style="list-style-type: none"> Compare or justify management practices for a given situation. Evaluate which management practices are optimal for use when producing a primary product. Explain how positive implications of environmental sustainability lead to the use of a particular management practice. Compare and contrast implications of the use of some management practices on environmental sustainability. Rank the possible management practices utilised in a specified production by their environmental implications. Evaluate the choice of management practices for a product on their environmental implications.