The Government of the Republic of the Union of Myanmar

Ministry of Education

## Year 1 Semester 1

# EDU1109
# Curriculum and Pedagogy Studies: Local Curriculum

Student Teacher Textbook

# PREFACE

The Myanmar Ministry of Education developed the four-year Education College curriculum, in line with the pre-service teacher education reform as specified in the National Education Strategic Plan (NESP) 2016-2021.

The Myanmar Education College curriculum consists of several components: the curriculum framework, syllabi, Student Teacher Textbooks, and Teacher Educator Guides. This curriculum for the four-year Education College was designed and structured to align with the Basic Education Curriculum and to equip student teachers with the competencies needed to teach effectively in Myanmar's primary and middle school classrooms. It is based on a Teacher Competency Standards Framework (TCSF) which articulates the expectations for what a teacher should know and be able to do in the classroom.

The curriculum follows a spiral curriculum approach, which means that throughout the four years student teachers return to familiar concepts, each time deepening their knowledge and understanding. To achieve this, the four-year Education College programme is divided into two cycles. The first cycle (Years 1 and 2) is repeated at a deeper level in the second cycle (Years 3 and 4) to enable student teachers to return to ideas, experiment with them, and share with their peers a wider range of practices in the classroom, with the option to follow up on specific aspects of their teaching at a deeper lev l.

The curriculum structure provides an integrated approach, where teaching of subject knowledge and understanding educational theories are learnt through a supportive learning process of relevant preparation and practical application and experience. The focus is, therefore, not just on subject content, but also on the skills and attitudes needed to effectively apply their knowledge, skills, and attitudes in teaching and learning situations, with specific age groups. As the focus is on all components of a 'competency' – knowledge, skills, attitudes and their effective application – it is referred to as a competency-based curriculum.

Accordingly, a competency-based curriculum is learner-centred and adaptive to the changing needs of students, teachers, and society. Where new concepts are learnt, they are then applied and reflected on

1. Learn (plan what and how to teach);
2. Apply (practise teaching and learning behaviours);
3. Reflect (evaluate teaching practice)

Beyond the Education College coursework, it is intended that student teacher graduates will be able to take and apply this cycle of 'learn, apply, and reflect to their own teaching to effectively facilitate the learning and development of Myanmar's next generation.

The Myanmar Education College curriculum was developed by a curriculum core team, which is a Ministry of Education-appointed team of Myanmar Education College teacher educators supported by the Ministry of Education, resource persons from the Universities of Education, University for the Development of National Races of the Union and a team of national and international experts. Overall guidance of the work was provided by the Department of Higher Education, Ministry of Education.

The curriculum development was also supported by the Strengthening Pre-Service Teacher Education in Myanmar project, with technical assistance from the United Nations Educational, Scientific and Cultural Organization (UNESCO) and financial contributions from Australia, Finland, and UK Governments. Substantial input to the drafting process was also provided by Japan International Cooperation Agency and the primary education curriculum development team through the Project for Curriculum Reform at Primary Level of Basic Education (CREATE) team.

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# HOW TO USE THIS TEXTBOOK

**Who will use this Local Curriculum textbook?**

This textbook has been designed to guide you, as a student teacher, through Year 1 of the Local Curriculum subject. In this textbook, you will find foundational information about Local Curriculum. The textbook also includes learning activities and additional resources to help you develop the knowledge, skills, and attitudes you need to be an effective teacher in Myanmar. You will use the textbook as a key resource in class; you can also use the textbook for independent self-study.

While the content in the textbook is addressed to you, as a student teacher, it is also a resource for your teacher educators, who will serve as your facilitators and mentors as you develop key competencies in Local Curriculum. Throughout this module, you and your teacher educator will work together, using this textbook as a tool for learning.

**When and where does Local Curriculum take place?**

Local Curriculum has been allotted twelve periods of teaching for each year of your four-year Education College programme. Classes will be held on your Education College campus.

**What is included in the Year 1 Local Curriculum  Student Teacher textbook?**

The textbook organisation and content align with the syllabus of the four-year Education College curriculum on Local Curriculum.

This textbook contains the following topics for Year 1 Local Curriculum:

- Introduction to Local Curriculum;
- Ethnic language and culture;
- Agriculture;
- Career Skills;
- Home management skills; and
- Assessment.

For each unit, you will be working through learning activities, both individually and with your peers as well as teacher educator, to deepen your knowledge, skills, and attitudes on the topic. The Content Map, below, highlights the expected learning outcomes and time allocations for each unit in this textbook.

**Table A. Year 1, Semester 1, Local Curriculum content map**

| Units | Sub-Units | Lessons | Learning Outcomes | TCSF | Periods |
|---|---|---|---|---|---|
| **1. Introduction to Local Curriculum** | 1.1. What is Local Curriculum? | 1.1.1. Why is Local Curriculum important? | • Explain what Local Curriculum is<br>• Demonstrate an understanding of the differences between the states/regions in Myanmar based on own experience related to tradition, culture, language, ethnicity<br>• Give examples of the importance of teaching Local Curriculum | A4.1 | 1 |
| | 1.2. Local Curriculum Topics in Basic Education | 1.2.1. Local Curriculum topics | • List and explain the different topics that will be included in the Local Curriculum at primary school<br>• Investigate international literature on Local Curriculum and explain how the Local Curriculum can make primary students' learning more relevant for local populations<br>• Demonstrate your understanding of the subject by redefining th 'definition of Local Curriculum | A4.1 | 1 |
| **2. Ethnic Language and Culture** | 2.1 Introduction to Learning Ethnic Language and Culture | 2.1.1. Learning ethnic language and culture | • Explain the limitation of monolingual education<br>• Explore international literature on the impact of using mother tongue as language of instruction | A5.1<br>A5.2 | 2 |
| | 2.2. Supporting Students' Learning | 2.2.1. How to support students learning ethnic languages | • Discuss the difficulties primar school students may have in learning ethnic languages and cultures and how teacher can support them<br>• Explain the importance of collaboration with ethnic language teachers at school and classroom level | A5.1<br>A5.2 | 1 |

| Units | Sub-Units | Lessons | Learning Outcomes | TCSF | Periods |
|---|---|---|---|---|---|
| **3. Agriculture** | 3.1. Plants and Seeds | 3.1.1. Plants | • Explain basic concepts and knowledge of agriculture to be taught to primary school students<br>• Demonstrate practical skills of basic agricultural science and plant propagation technique<br>• Explain the importance of plants and classify different plants | A5.1<br>B1.1 | 1 |
| | | 3.1.2. Seeds | • Demonstrate basic knowledge of seeds and skills of seed germination | A5.1<br>B1.1 | 1 |
| | 3.2. Soils and Fertilisers | 3.2.1. Soils | • Identify the importance of soils, basic soil types and soil pH | A5.1<br>B1.1 | 1 |
| | | 3.2.2. Fertilisers | • Explain nutrients for plants, different fertiliser types and application methods | A5.1<br>B1.1 | 1 |
| | 3.3. Plant Propagation | 3.3.1. Understanding the propagation of plants | • Explain what plant propagation is and how to propagate some plants by the air-layering method.<br>• Explain what plant propagation is by cutting and propagating some plants by stem cutting methods | A5.1<br>B1.1 | 2 |
| | 3.4. Insect Pests, Diseases and Methods of Control | 3.4.1. Insect pests and methods of control | • Recognise the nature of insects, the damage they can cause to crops<br>• Describe the methods of pest control<br>• Explore modern trends in agriculture | A5.1<br>B1.1 | 1 |
| **Total number of periods** | | | | | 12 |

The overall objective of Local Curriculum is for you to be familiar with the concept of Local Curriculum in the Basic Education Curriculum and how this curriculum is developed by and responds to local needs. You will acquire knowledge and skills in the range of topics identified for Local Curriculum, in particular agriculture. At the end of the course, you will have developed a deep understanding of the purpose and importance of Local Curriculum for the relevance of education in Myanmar local contexts and its contribution to inter-cultural respect and peace building.

The content of this textbook is based on the Myanmar Teacher Competency Standards Framework (TCSF), which articulates the expectations for what you should know and be able to do in the classroom. The teacher competencies in focus for the Local Curriculum module include:

**Table B. Local Curriculum Teacher Competencies in Focus**

| Competency Standard | Minimum Requirement | Indicators |
|---|---|---|
| A1: Know how students learn | A1.1 Demonstrate understanding of how students learn relevant to their age and developmental stage | A1.1.1 Give examples of how the students' cognitive, physical, social, emotional and moral development may affect their learning<br><br>A1.1.2 Prepare learning activities to align with students' level of cognitive, linguistic, social, emotional and physical development |
| | A1.2 Demonstrate understanding of how different teaching methods can meet students' individual learning needs | A1.2.2 Prepare focused and sequenced learning activities to assist students to link new concepts with their prior knowledge and experiences |
| A2: Know available instructional technology | A2.1 Demonstrate understanding of appropriate use of a variety of teaching and learning strategies and resources | A2.1.1 Plan learning experiences that provide opportunities for student interaction, inquiry, problem-solving and creativity<br><br>A2.1.2 Use teaching methods, strategies and materials as specified in the textbooks and additiona low cost support materials to support student learning |

| Competency Standard | Minimum Requirement | Indicators |
|---|---|---|
| | A2.2 Demonstrate understanding of appropriate use of Information Communication Technology (ICT) in teaching and learning | A2.2.1 Describe the function and purpose of online and offline educational tool and materials to support the teaching and learning process |
| A3: Know how to communicate well with students and their families | A3.1 Demonstrate understanding of the role, and expected duties of teachers in Myanmar | A3.1.1 Describe the role and five dutie of Myanmar teachers as socially accepted norms |
| | A3.2 Demonstrate respect for the social, linguistic and cultural diversity of the students and their communities | A3.2.2 Be aware of social and cultural background of parents, community elders and leaders when interacting with them |
| A4: Professional knowledge and understanding– Curriculum | A4.1 Demonstrate understanding of the structure, content and expected learning outcomes of the Basic Education Curriculum | A4.1.2 Prepare lesson plans reflecting th requirements of the curriculum and include relevant teaching and learning activities and materials<br><br>A4.1.3 Describe the assessment principles underpinning the primary curriculum |
| A5: Know the subject content | A5.1 Demonstrate understanding of the subject matter to teach the subject/s for the specified grad level/s | A5.1.1 Describe the key concepts, skills, techniques and applications for the subjects covered in the grade levels taught |
| | A5.2 Demonstrate understanding of how to vary delivery of subject content to meet students' learning needs and the learning context. | A5.2.1 Describe ways to contextualise learning activities for the age, language, ability and culture of students to develop understanding of subject related principles, ideas and concepts<br><br>A5.2.2 Explain how lessons are contextualised to include localised information and examples related to the subject content, concepts and themes |
| B1: Teach curriculum content using various teaching strategies | B1.1 Demonstrate capacity to teach subject-related concepts and content clearly and engagingly | B1.1.1 Clearly explains the curriculum content and intended learning outcomes |

| Competency Standard | Minimum Requirement | Indicators |
|---|---|---|
| | B1.2 Demonstrate capacity to apply educational technologies and different strategies for teaching and learning | B1.2.1 Use teaching methods and learning strategies appropriate for the class culture, size and type<br><br>B1.2.2 Use knowledge of literacy and numeracy instructional strategies to support students learning in different subject areas<br><br>B1.2.3 Create opportunities for students to investigate subject-related content and concepts through practical activities |
| | B1.3. Demonstrate good lesson planning and preparation in line with students' learning ability and experience | B1.3.1 Plan and structure lesson to ensure all of the lesson time is used effectively<br><br>B1.3.2 Provide lesson introductions to link new learning to prior learning, to engage students' interest and to motivate them in learning<br><br>B1.3.3 Prepare focused and sequential learning experiences that integrate learning areas and are responsive to students' interests and experience<br><br>B1.3.4 Use questioning techniques and examples to introduce and illustrate concepts to be learnt |
| B2: Assess, monitor and report on students' learning | B2.1 Demonstrate capacity to monitor and assess student learning | B2.1.2 Use assessment information to plan lessons |
| B3: Create a supportive and safe learning environment for students | B3.1 Demonstrate capacity to create a safe and effective learning environment for all students | B3.1.1 Use space and classroom materials and resources to ensure involvement of all students in learning activities<br><br>B3.1.2 Encourage students to interact with each other and, to work both independently and in teams<br><br>B3.1.3 Model and promote good health and safety (administration of medication, CPR and First Aid training, fire and disaste drills, abuse and neglect, communicable disease) |
| | B3.2 Demonstrate strategies for managing student behaviour | B3.2.2 Encourage students to interact with each other with mutual respect and safety |

| Competency Standard | Minimum Requirement | Indicators |
|---|---|---|
| B4: Work together with other teachers, parents, and community | B4.1 Demonstrate strategies for working together with other teachers, parents, and the local community to improve the learning environment for students | B4.1.3 Seek colleagues' perspectives in attempting to respond to learning issues and accept feedback positively |
| C1: Service to profession | C1.1 Demonstrate values and attitudes consistent with Myanmar's tradition of perceiving teachers as role models | C1.1.1 Comply with professional codes of conduct, rules and regulations in line with the five traditional responsibilities of th Myanmar teacher |
| C2: Service to community leadership | C2.1 Demonstrate commitment to serving the school and community as a professional member of the teaching profession | C2.1.1 Contribute actively to a range of school and community activities |
| C3: Promote quality and equity in education for all students | C3.1 Demonstrate a high regard for each student's right to education and treat all students equitably | C3.1.1 Show awareness of the right to education of every child and a commitment to nurturing the potential in each student |
| | C3.3 Demonstrate capacity to build students' understanding of different cultures and global citizenship | C3.3.1 Integrate concepts of sustainability, equality, justice and the rights and responsibilities of students into class and school activities |
| D1: Reflect on own teachin practice | D1.1 Regularly reflect on ow teaching practice and its impact on student learning | D1.1.2 Use information from a variety of sources to improve teaching practice and student learning |
| D2: Professional growth and development - Collaborative learning | D2.1 Improve own teaching practice through learning from other teachers and professional development opportunities | D2.1.1 Discuss teaching practices with supervisors, colleagues and willingly seek constructive feedback<br><br>D2.1.3 Establish goals for own professional development as a teacher<br><br>D2.1.4 Participate in professional activities conducted by school clusters and recognised professional associations |
| D3: Participate in professional learning to improve teaching practice | D3.1 Demonstrate understanding of the importance of inquiry and research-based learning to improve teaching practice | D3.1.1 Identify relevant professional learning material to improve own practice |

*Source:* Myanmar Teacher Competency Standards Framework (TCSF), Beginning Teachers, Draft Version 3.2. (May 2019) (pp 30 – 36)

## How do I use this textbook?

You can use this textbook both for your own self-study and as an in-class resource for learning activities facilitated by your teacher educator. Each unit in the textbook includes:

**Expected learning outcomes:** These are listed at the beginning of each unit and at the beginning of each lesson. The expected learning outcomes indicate what you should know and be able to do by the end of the lesson or unit.

**Learning content:** The learning content for each unit is broken down into sub-units and lessons that cover subject content knowledge that is important for you to know.

**Learning activities:** The learning activities included in the textbook are individual activities that you can do to help reinforce and deepen your knowledge and understanding of a topic. Your teacher educator will also facilitate learning activities during class. These may be individual, partner, small group, or whole class activities designed to help you achieve the learning outcomes for each lesson.

**Unit summary:** At the end of the unit, there is a brief summary of the main points of the unit to help you review and remember the most important information.

**Review questions:** You can use the review questions to test your own understanding of the unit content, or to help you study for an exam.

**Further reading:** Each unit lists suggestions of additional resources on the topic. You can look these up in the library, on the internet, or in your Education College's e-library to learn more about the topic.

**Unit reflection:** Taking the time to deliberately think about, or reflect, on what you have learned will help you remember and apply that learning, and make connections with other subject areas and real-life. Each unit ends with some suggestions on how you can reflect and follow-up on what you have learned in the unit.

At the end of this textbook, you will find a **Glossary** with the definitions of words found throughout the textbook that might be new to you. These words are listed in alphabetical order. You will also find a list of all the **Bibliography** which are the original sources of information used throughout the textbook.

Remember, your teacher educator is there to help facilitate your learning in this module. If there is material you do not understand in the textbook, be sure to ask your teacher educator, or your classmates, for help. As a student teacher, you are part of a community of collaborative learning within your Education College as you work – together with your peers and guided by your teacher educators – to earn your teaching qualification.

# Unit 1

# Introduction to Local Curriculum

This unit is an introduction to Local Curriculum, and explains the reasons behind the development of this subject. The relevance and importance of a Local Curriculum in Myanmar is explained and there are examples given of Local Curriculum being implemented in other countries. This unit will help you understand the importance of Local Curriculum as a subject area in the primary schools across Myanmar.

**Expected learning outcomes**

**By the end of this unit, you will be able to:**

- Explain what Local Curriculum is;
- Demonstrate an understanding of the differences between the states/regions in Myanmar based on your own experience related to tradition, culture, language and ethnicity;
- Give examples of the importance of teaching Local Curriculum;
- List and describe the different topics that will be included in the Local Curriculum at primary school;
- Explore international literature on Local Curriculum and explain how the Local Curriculum can make primary students' learning more relevant for local populations; and
- Demonstrate your understanding of the subject by redefining the 'definition of Local Curriculum.

# 1.1. What is Local Curriculum?

This sub-unit will introduce the basic concepts behind a Local Curriculum and encourage you to explore the opportunities that can be made available to primary school students through studying Local Curriculum.

## 1.1.1. Why is Local Curriculum important?

**Expected learning outcomes**

**By the end of the lesson, you will be able to:**

- Explain what Local Curriculum is;
- Demonstrate an understanding of the differences between the states/regions in Myanmar based on your own experience related to tradition, culture, language and ethnicity; and
- Give examples of the importance of teaching Local Curriculum.

## Understanding Curriculum

A **curriculum** is the content that students must learn in school, and this content is typically provided to schools in the form of textbooks. It is essential to schools as it provides purposeful structure and planning for learning to ensure students acquire necessary competencies to advance into the next grade. The role of curriculum extends beyond the corridors of the school as it also supports the development of societies and what the society aspires for. As it is designed to provide for the societal needs, it is often tied to government initiatives. For instance, if the country's development goals for the next five years were to boost its digital economy, curriculum would reflect this by focusing on the foundational knowledge and skills required for carrying out business on the internet. Thus, when changes and developments occur that impacts society, curriculum will accordingly be adapted to account for these changes. It is key to view curriculum not as being static, but as one that is constantly transforming through cycles of development and review.

A curriculum can consist of the following depending on level of prescription:

1. The standards and objectives that state what the curriculum sets out to achieve.
2. The content, such as the concepts, beliefs, facts, skills and competencies to be learned.
3. The sequence of the learning experience
4. The instructional methods that describes the activities for learning content
5. The resources such as videos, readings, and other materials to support learning
6. The assessments used to evaluate student learning and monitor and evaluate the achievement of objectives.

The curriculum process encompasses three states seen below. Teachers will often act as implementers of pre-packaged national curriculum, requiring a deep understanding of the curriculum to ensure alignment between all three states. Other times, teachers may be involved in developing and improving curriculum, requiring a higher set of skills such as an understanding of educational philosophies that guide the curriculum design, awareness of societal needs, and analysis of student outcomes for recommended changes.

The three states of the formal curriculum[1]

1. The planned curriculum
    a. What is intended by designers
2. The delivered curriculum
    a. What is organised by administrators
    b. What is taught by teachers
3. The experienced curriculum
    a. What is learned by students

## Hidden curriculum

There is an additional concept of curriculum that must also be considered, this is called the hidden curriculum.[2] This unofficial curriculum refers to the unwritten learning that students can attain whilst at school in addition to the official curriculum of learning. Through their school life students naturally absorb learning from a number of sources such as their peers and their interactions with teachers and members of the wider community outside of the classroom. Though the hidden curriculum students may learn about social interactions and behaviours, cultural values, and perspectives.

The hidden curriculum concept is based on the recognition that students absorb lessons in school that may or may not be part of the formal course of study – for example, how they should interact with peers, teachers, and other adults; how they should perceive different races, groups, or classes of people; or what ideas and behaviours are considered acceptable or unacceptable. The hidden curriculum is described as "hidden" because it is usually unacknowledged or unexamined by students, educators, and the wider community.

## Localisation of curriculum

What students learn will prepare them for getting a job in the future. Imagine two villages. One village is by the sea and the people make a living from fishing. The other village is far inside the country and farming is the main source of income. Both villages are provided with the same textbook, but the textbook only focuses on knowledge and skills for becoming a farmer. This is a simple example which illustrates that for people in the village by the sea, this textbook will seem less relevant for them, not supporting them in providing their children with the knowledge and skills to make a living from fishing.

[1] Prideaux., D. (2003). ABC of learning and teaching in medicine: Curriculum design. BMJ, 326, 268-270.
[2] https://www.edglossary.org/hidden-curriculum/

In order to make the textbooks, or curriculum, provided to students in a country more relevant for what is important for them, their families, and their communities where they live, parts or components of a curriculum may need to be determined at the local community or school level instead of the national level.[3] This gives the students across the country a more meaningful learning experience and increases their motivation for learning. For example, in communities where farming is a main source of income, including Agriculture as a subject of learning in school could be important, while this would be less important for other parts of the country.

A Local Curriculum is:

- About a place: making use of local context and resources to frame learning;
- By a place: designed by local level such as state/regional government, and communities; and
- For a place: meeting the specific needs of children and local communities [4]

The main objectives of a Local Curriculum are to:

- Create learning experiences that are engaging for children from all backgrounds;
- Increase children's understanding of and attachment to the place where they live; and
- Connect schools more deeply within their communities and localities.[5]

**Introduction of Local Curriculum in Myanmar**

In Myanmar, the National Education Law (NEL) (2014, amended 2015) provides for the first time the opportunity for state governments to develop a Local Curriculum that sits in line with the Basic Education Degree Curriculum Framework, and that meets the local education needs for the different states or regions in Myanmar.

[3] Glossary of Curriculum Terminology, Localization of Curriculum, UNESCO-IBE, 2013
[4] (RSA 2012,p.5) cited in Evans W. and Savage J. (2015) p.6 Developing a Local Curriculum: Using your locality to inspire
[5] (Ibid.) cited in Evans W. and Savage J. (2015) p.6 Developing a Local Curriculum: Using your locality to inspire teaching and learning. P.6.

Topics can be chosen to be taught up to five periods per week, a total of 120 periods per year. The Local Curriculum content can either be integrated with the related subjects of the (main) curriculum or by teaching some of the contents as separate subjects. The main content proposed in the Basic Education Curriculum Framework (6th version) is: ethnic languages, local histories and traditional cultures, local business situation, agriculture businesses and basic computer[6]. State/Region level governments are responsible for the planning and implementation of all the processes of Local Curriculum, including the selection of topics of learning, the development of textbooks, preparation of lessons, and methods of assessment.

Local Curriculum "responds to many of the 13 principles of Basic Education Curriculum in Myanmar, in particular: appreciation of all cultures, customs and traditions; peaceful coexistence and living in harmony; and promoting equality, despite the differences in gender, race, language, etc."[7]The introduction of Local Curriculum is in line with one of the nine transformational shifts of the National Education Strategic Plan (NESP) 2016-2021 on Basic Education Curriculum: *"All school children develop knowledge, skills, attitudes, and competencies that are relevant to their lives, and to the socio-economic development needs of Twenty-First Century Myanmar."*[8]

The development of Local Curriculum and its inclusion into the National Basic Education Curriculum Framework is an important step for the education system of Myanmar, and demonstrates a forward-thinking approach to education in line with the international trend of making curricula more relevant to the diverse nature of countries. Localisation of content is essential for the quality of the Myanmar curricula.[9]

**Why has Local Curriculum been developed?**

Local Curriculum has been developed with the intention of harmonising the social and local needs of each state and region with the national curriculum. This is especially important for promoting the learning and preservation of ethnic languages. Unit 2 is dedicated to ethnic languages and culture and this provides an opportunity to contextualise the content of teaching and learning through the 'mother tongue'.

[6] The Basic Education Curriculum Framework (6th version), Ministry of Education, The Government of the Republic of Myanmar
[7] UNICEF: MYWP 2018 & 2019, Sub-Activity 2.4.3.016
[8] UNICEF: MYWP 2018 & 2019, Sub-Activity 2.4.3.
[9] What makes a quality curriculum? UNESCO-IBE, 2016

Myanmar is a nation of multi-ethnic and multilingual societies where the rights of its ethnic peoples are guaranteed by the constitution. In order to equip children with the knowledge, skills, and attitudes to function in an ethnically diverse nation, curriculum should reflect this cultural diversity in an inclusive manner. "Multicultural education... [includes] ...the movement toward equity, curriculum reform, the process of becoming interculturally competent, and the commitment to combat prejudice and discrimination" (Bennett, 1999, p. 11).[10] By promoting and recognising the ethnic diversities of Myanmar through the development of a location-specific subject syllabus, it is expected that ethnic minority children will develop greater self-identity and demonstrate increased self-esteem. It is also anticipated that this will contribute towards the improvement of teaching and learning achievements, and support inter-cultural respect and understanding.[11]

**How has Local Curriculum been developed?**

By its very nature, it is important that Local Curriculum is developed by senior officials, experienced educators, and local community members in each state or region. The external experts in the Local Curriculum development team with valuable understanding of the local needs, contexts, cultures, customs, and languages may include members of civil societies, community organisations, and the local ethnic culture and literature committees of respective states and regions. The subject content is specific to each state or region, with the intention of meeting the local needs. The Local Curriculum Implementation Guide states: "Local curriculum is a learning area which needs to be decided and designed based on the educational requirements for each local state and region."[12]

A Local Curriculum implementation team was created in each state or region that oversees the development and implementation of the subject. The Local Curriculum implementation team has a number of responsibilities, which include:

- Organising the Local Curriculum development team and assigning their duties and responsibilities;
- Supervising the Local Curriculum development team;
- Assisting the Local Curriculum development team to develop the curriculum (e.g. place, references, and related documentations;

[10] Bennett, C. (1999). Comprehensive multicultural eduction, theory and practice. Boston: Allyn and Bacon.
[11] Local Curriculum Implementation Guide, February 2017, p2.
[12] Local Curriculum Implementation Guide, February 2017, p.2.

- Selecting Local Curriculum teachers, assigning their duties and responsibilities, and deciding the amount of honorarium;
- Supervising the implementation of the Local Curriculum; and
- Conducting training, and taking responsibility for the textbooks, teacher guides, and teaching and learning materials.

A Local Curriculum development team has been created in each state or region to oversee the development of the Local Curriculum. The members are selected on the following criteria:

- Knowledge of local culture and customs, ethnic language, and literature;
- Their outstanding achievements in the field of education
- Their teaching experience; and
- Their expertise in the local situation.

The Local Curriculum development team is made up of the following people:

**Table 1.1. Local Curriculum Development Team**

| | Designation | Title |
|---|---|---|
| 1 | State/Region social minister | Chairman |
| 2 | State/Region Ethnic Affairs Minister | Co-chair |
| 3 | State/Region level education director | Member |
| 4 | Representatives of university/college | Member |
| 5 | District level education officer | Member |
| 6 | Representatives of township level education officer | Member |
| 7 | Retired teachers/local experts | Member |
| 8 | State/Region deputy director | General secretary |

Their responsibilities include:

- Establishing the learning objectives of Local Curriculum;
- Identifying the best learning activities that can be used to achieve these learning objectives;
- Developing the lessons in line with the strands and topics of designated grade level;
- Selecting the most appropriate student-centred teaching methodologies;
- Identifying relevant and effective types of assessment;
- Developing some textbooks and creating the teachers' guides;
- Identifying relevant and exciting teaching and learning materials; and
- Providing teacher training and capacity building activities.

The implementation of Local Curriculum will facilitate an opportunity to upgrade the teaching methods currently in use in schools. Student-centred teaching methods will be introduced, and students will have the chance to take part in excursion study visits to museums, libraries, historical places, and remarkable places in the local area. Respected local people will also be invited to the school to talk to the students on locally relevant subjects.[13]

**What are the Challenges and Opportunities of Teaching a Local Curriculum?**

There are many documented opportunities afforded by the development of a Local Curriculum. For example, the case study examined in Chunrasaksakun (2015) is of the development of a Local Curriculum in Watsamankit Elementary School in Thailand. The experience of the students at the school was observed to be mainly positive.

It was observed that students *"gained more knowledge about integrated agriculture, and developed more desirable behaviours, skills, and attitudes toward agriculture as an occupation. Most students enjoyed the learning activities. They thought that they had more experience of authentic learning. They learned more about their community, and they can now apply this knowledge in their daily life."*[14]

[13] Local Curriculum Implementation Guide, February 2017, p2.

[14] Chunrasaksakun C. et al. 2015. 'Developing Local Curriculum framework on water resource and disaster course for enhancing students' learning achievements in the basic educational system', Department of Curriculum and Instruction, Faculty of Education, Khon Kaen University, Thailand

An improved relationship was also observed between the school and the local community, with greater cohesion seen within families and increased interactions between the students and teachers.

Chunrasaksakun (2015) also highlights the positive effects the introduction of Local Curriculum had on the quality of teaching, and even on the involvement of members of the local community in the teaching and learning process. Teachers gained a better understanding of the approached to student-centred learning and also developed a closer relationship with their students. It was also observed that teachers developed better relationships with parents and community members as well through the teaching of Local Curriculum. The local community also demonstrated a greater willingness to participate in the teaching and learning process. They developed closer relationships with the schools and teachers.

However, the implementation of a Local Curriculum can also present some challenges. These include the management of the complex structures established to oversee the development of the syllabus and teaching materials. A potential lack of self-confidence may be felt by the teachers as they have to come to terms with and use modern student-centred methods of teaching and integrate authentic outcome-based assessment.[15]

Challenges that may be faced with regards the relevance of the topics covered in Local Curriculum can be overcome through the development of a close cooperative relationship between the schools and the local community.

As you progress through the syllabus, you will not be preparing to teach ethnic language. Specific ethnic language teachers will be appointed by the Ministry of Education for this. This means your focus will be to understand what will be expected from you and to develop a positive attitude towards the concept of Local Curriculum, and especially the teaching of ethnic languages. It is important to consider how you can support and collaborate with the ethnic language teachers.

[15] Chunrasaksakun C. et al. 2015. 'Developing Local Curriculum framework on water resource and disaster course for enhancing students' learning achievements in the basic educational system', Department of Curriculum and Instruction, Faculty of Education, Khon Kaen University, Thailand

According to the Local Curriculum Implementation Guide, Local Curriculum should have a positive impact on the local community, and "provide an opportunity to contextualise the content of teaching and learning by mother tongue, to uplift the self-esteem of ethnic minority children through their learning achievement, while promoting intercultural respect and understanding."[16] Local Curriculum will bring a positive impact on society as a whole by providing education through an equity based approach, thus empowering students and supporting the integration of local communities into mainstreamed society.

The Implementation Guide goes on to explain the "outcome of Local Curriculum implementation: Students will be citizens who support the growth of the local economy through the development of national spirit, and through valuing the importance of local languages, literature, art, culture and customs, and conservation. Thus, upgrading and supporting their development as the new generation."[17]

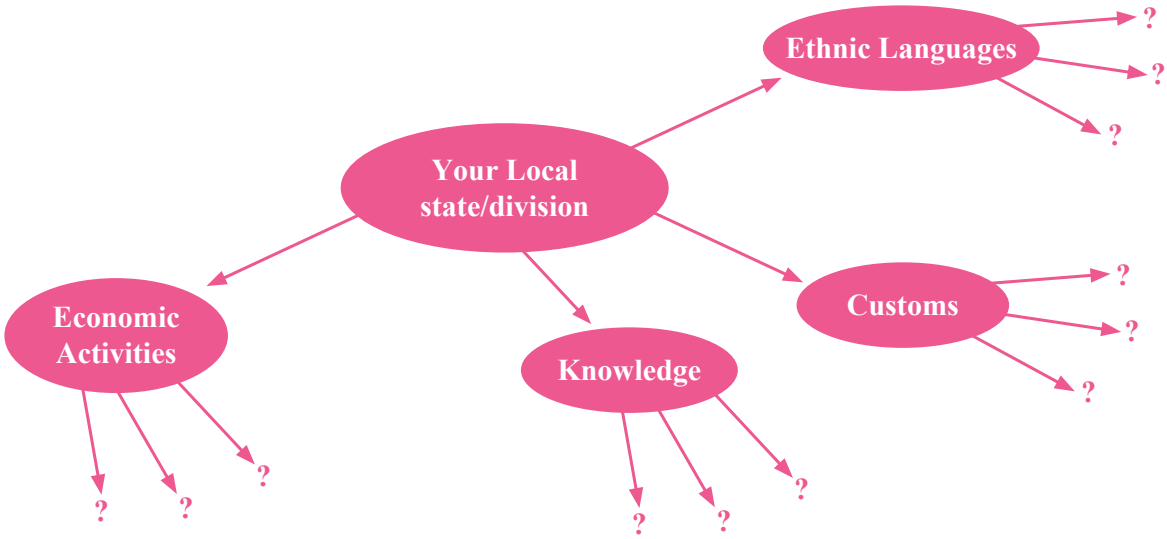
**Learning activity 1**

The purpose of this activity is to encourage you to consider the local individualities that make up the different states and regions of Myanmar. These include, although are not limited to, ethnicity, culture, histories and traditions, language, and income generating activities such as farming. Through this reflection, you will be able to identify with the concept of a Local Curriculum, and consider a curriculum that ensures the inclusion and equity of every student in every part of the country.

You will be asked to brainstorm unique features of your state or region, through mind-mapping. With mind-mapping, you begin with a general idea, your state or division, and expand on the unique features of your state or region further by linking it to more specific features such as the example seen below. You are free to create different versions of the example and be more specific. For brainstorming ideas, you should consider your family and community, the schools that you attended, your language, and the economic activities in your state/region, or area. You should make notes of the things that you consider to be unique to your background, and that are perhaps different to other states or regions in Myanmar. For example, what is the knowledge old people in your community have that is not taught in school? If you find yourself struggling to commence the activity, your teacher educator can give you some examples to assist you.

[16] Local Curriculum Implementation Guide, February 2017
[17] Local Curriculum Implementation Guide, February 2017

**Figure 1.1. Mind map example**




### Learning activity 2

The purpose of this activity is to allow you to hear and see first-hand what the rationale behind the development of the Local Curriculum is.

Your teacher educator will provide you a briefing on the rights of ethnic children established nationally and internationally and in particular relation to education to clarify the importance of Local Curriculum in upholding those rights. You will then hear from relevant officials on the rationale and process behind developing the Local Curriculum. You may view a video of the members of Local Curriculum development teams or Ministry of Education (MoE) or they may be invited to the class as guest speakers.[18]

### Learning activity 3

The purpose of this activity is to use the information from the previous activities in the development of a critical analysis of Local Curriculum.

[18] In the event that a video or personal appearance is not possible, a written statement may be used to introduce the same information.

You will first engage in a short group discussion on the opportunities and challenges that you may face in the teaching of Local Curriculum. It must be highlighted here that the teaching of ethnic languages is not to be included as a challenge, as this will be taught by specialist local language teachers. The teacher educator will provide a summary of your findings on the board.

The teacher educator will then assign readings from the Local Curriculum Implementation Guide (Section 17) and the Local Curriculum syllabus. The teacher educator will elaborate on the meaning of the words contained in the following excerpts from the reading seen below. You are encouraged to ask the teacher educator for any clarifications on the meaning of words and phrases you do not understand. You will be asked to provide other positive and constructive words to describe the opportunities afforded by Local Curriculum.

*"Outcome of Local Curriculum implementation: Students will be citizens who support local economic development by developing national spirit, valuing local language, literature, art, culture, and custom, and practicing conservation, upgrading and transferring them to new generation."*[19]

*"The main contents dealt with in Local Curriculum are learning ethnic languages, their own histories and traditional cultures, the local business situation, local agriculture, and basic computer skills. Local Curriculum development, especially ethnic language learning, provides an opportunity to contextualise the content of teaching and learning by mother tongue, to uplift self-esteem of ethnic minority children through their learning achievements, and to promote inter-cultural respect and understanding."*

**Review questions**

1. What is a Local Curriculum?
2. How does a hidden curriculum influence the students
3. Why has Local Curriculum been developed?

[19] Local Curriculum Implementation Guide, February 2017, p.4.

# 1.2. Local Curriculum topics in Basic Education

This sub-unit will introduce you to the international approach to Local Curriculum and you will have the opportunity to explore examples of Local Curriculum in practice in different countries. You will also have the chance to define for yourselves, based on your learning, what a Local Curriculum actually is.

## 1.2.1. Local Curriculum topics

**Expected learning outcomes**

**By the end of the lesson, you will be able to:**

- List and describe the different topics that will be included in the Local Curriculum at primary school;
- Explore international literature on Local Curriculum and explain how the Local Curriculum can make primary students' learning more relevant for local populations; and
- Demonstrate your understanding of the subject by redefining the 'definition of Local Curriculum.

Local Curriculum has been developed to include the most relevant and important topics that meet the needs of students and local communities. At primary level, there are up to five teaching periods per week available, up to a maximum total of 120 teaching hours per Local Curriculum has been developed to include the most relevant and important topics that meet the needs of students and local communities. At primary level, there are up to five teaching periods per week available, up to a maximum total of 120 teaching hours per academic year. This equates to as much as 14% of the primary school curriculum.[20]

The topics that will be covered in the basic education primary curriculum are as follows:

**Table 1.2. Basic Education Curriculum: Local Curriculum**

| Learning area | Grade 1 | Grade 2 | Grade 3 | Grade 4 | Grade 5 |
|---|---|---|---|---|---|
| Local Curriculum | Up to 5 teaching periods per week (this should not exceed 120 hours per year) | | | | |
| | Ethnic languages | | | • History, culture and custom of local ethnics<br>• Local economic situation<br>• Agricultural activities/ business related with local needs | |

**Learning activity 1**

The purpose of this activity is to encourage you to consider the topics you think should be included in a Local Curriculum based on your understanding of the subject from Lesson 1.1.1.

You will be asked to consider "What is a Local Curriculum", by providing a definition of the terms in your own words. Consider the purpose of a Local Curriculum in the school system. What needs does it aim to resolve? You will also be asked "What makes up a Local Curriculum". Along with your peers you will contribute towards a jointly created idea of what makes up a Local Curriculum.

[20] Local Curriculum Syllabus

**Learning activity 2**

The purpose of this activity is to allow you to engage with the syllabus of the Local Curriculum and gain an understanding of the subject areas covered.

You will be separated into small working groups to study the syllabi of Social Studies and Local Curriculum. The teacher educator will ask you to pinpoint in group discussions and share with the class the similarities and differences of the two in terms of objectives and topic areas.

The teacher educator will also ask you to study the Basic Education Curriculum Framework, and the Ministry of Education guidelines for drafting Local Curriculum in groups. Each group will be given instructions on which topic areas to investigate and discuss.

Upon the conclusion of the activity, your group will elect one member to explain to the rest of the class your topic area, indicating the relevance to the 'definition' of Local Curriculum that was established in Lesson 1.2.1.

**Learning activity 3**

The purpose of this activity is to allow you to investigate the concept of a Local Curriculum from an international (outside of Myanmar) perspective.

You will be supplied with different examples of international literature[21] to investigate alternative views and approaches to Local Curriculum by reading specific pages or passages of text. After reading, you will be grouped with other student teachers to discuss your findings and compare your thoughts and ideas. In a class discussion, the teacher educator will ask you for your thoughts on the international approach to Local Curriculum, and your understanding on how Local Curriculum can be made more relevant for the intended primary school children.

[21] Either in textbook format, printed sheets or web addresses.

### Learning activity 4

The purpose of this activity is to encourage you to refine their original thoughts on Local Curriculum based on your learning of the subject over the two lessons.

You will be asked to consider the list of potential Local Curriculum subjects you created in Lesson 1.2.1, and try to collectively improve upon it through the use of the learning you have received.

### Review questions

Write three key learning points you have taken from the two lessons, and why you consider those points relevant and important to your understanding of Local Curriculum. Discuss these points with one of your peers.

# Unit Summary

**Key messages**

- The topics included in Local Curriculum have been selected to be relevant to each state or region of Myanmar, but each Local Curriculum will be individually written by education experts in that area to ensure relevance.

- Local Curriculum has been introduced to meet the unique educational needs of different local areas, and to reflect the different ethnicities, cultures, histories and traditions, languages, and income generating activities.

- Although there are many challenges faced by the students in teaching Local Curriculum, there are many opportunities afforded to primary school children through this new subject.

- Local Curriculum has been developed using international best-practice as a benchmark. Outside of Myanmar, Local Curricula are widely used to great effect.

## Unit reflection

This unit has dealt with the basic concepts behind a Local Curriculum and has encouraged you to explore the opportunities that can be made available to primary school students through studying Local Curriculum.

You have been introduced to the three states of the formal curriculum, which have been demonstrated as: The planned curriculum, i.e. what is intended by the designer; the delivered curriculum. i.e., what is organised by administrators and what is taught by teachers; and the experienced curriculum, i.e. what is learned by students.

The additional concept of the hidden curriculum was also covered.

How influential is the hidden curriculum in the development of students

Why is it important to recognise the potential negative consequences of the hidden curriculum?

You have been introduced to a definition of Local Curriculum, and you should be aware of the component parts that make up Local Curriculum and the objectives of a Local Curriculum.

This unit highlighted the process that has been taken in Myanmar to develop Local Curriculum and why Local Curriculum is important for Myanmar.

Finally, you have had the opportunity to explore international literature on Local Curriculum and been introduced to some of the challenges and opportunities that a Local Curriculum can bring to primary schools.

What opportunities can you foresee in Myanmar through the development of a Local Curriculum?

## Further reading

**1.1.**

Ministry of Education (MOE), The Government of the Republic of the Union of Myanmar. (2019). *Education College B.Ed. Primary school subject syllabus: Local Curriculum.* Ministry of Education.

Lwin, T. (2002). Issues Surrounding Curriculum Development in the Ethnic Minority Areas of Burma.

Lwin, T. (2011). Local Curriculum Implementation Guide, February 2017 Annex. In *Language, Identities and Education: in relation to Burma/Myanmar.*

**1.2.**

*Education College B.Ed. Primary school subject syllabus: Local Curriculum.* (n.d.).

Boonreang, K., & et al. (2004). *"Local-based Curriculum Development: A Case Study of Watsamankit Elementary School, Thailand."* Australia: AARE.

Bühmann, D., & Trudell, B. (2008). *"Mother Tongue Matters, Local Language as a key to Effective Learning."* UNESCO.

Chunrasaksakun, C., & et al. (2015). Local Curriculum Implementation Guide, February 2017. *In Developing Local Curriculum framework on water resource and disaster course for enhancing students' learning achievements in the basic educational system.* Thailand: Khon Kaen University Department of Curriculum and Instruction.

Haddad, C. (2007). *"Mother Tongue-based Literacy Programmes: Case Studies of Good Practice in Asia"*. Bangkok: UNESCO Bangkok.

King, L. (2013). *"Education in a multilingual world"*. UNESCO.

Lwin, T. (2007). *Education and Democracy in Burma.*

South, A., & Lall, M. (2016). *Schooling and Conflict: Ethnic Education and Mother Tongue-based Teaching in Myanmar.*

Stabback, P. (2016). *'What Makes a Quality Curriculum?'* International Bureau of Education.

# Unit 2

# Ethnic Language and Culture

The unit introduces you to the ethnic languages and culture component of Local Curriculum. You will explore common issues for minority students concerning the language of instruction and the rationale behind promoting ethnic language development with research and case studies from international literature. The unit also delves into the likely challenges faced by minority students when learning ethnic languages and the opportunities for collaboration with ethnic language teachers in reference to theories of bilingualism/ multilingualism.

**Expected learning outcomes**

**By the end of this unit, you will be able to:**

- Explain the limitation of monolingual education;
- Explore international literature on the impact of using mother tongue as a language of instruction;
- Discuss the difficulties primary school students may have in learning ethnic language and culture and how the teacher can support them; and
- Explain the importance of collaboration with ethnic language teachers at school and classroom level.

# 2.1. Introduction to Learning Ethnic Language and Culture

This sub-unit is intended to introduce you to the importance of the use of mother tongue as the language of instruction at Primary School and the benefits that be seen through the teaching of ethnic languages in all Primary Schools in all states of Myanmar.

## 2.1.1. Learning ethnic language and culture

**Expected learning outcomes**

**By the end of the lesson, you will be able to:**

- Explain the limitation of monolingual education; and
- Explore international literature on the impact of using mother tongue as language of instruction.

## The Limitations of Monolingual Education

Going to school for the first time can be a time of fear and anxiety for many students. For minority students in particular where the medium of instruction is a language they may not understand, these feelings can be intensified. The Burmese language, recognised as the country's official language, had been the sole medium of instruction until recent reforms by the National Education Law (NEL) in 2014. For some ethnic minority students, as Burmese may not be their mother tongue, they may struggle to grasp concepts taught in an unfamiliar language. They may fail to actively participate in class and complete learning tasks. Even if they are able to overcome these barriers and become fluent in the Burmese language in their later years, their local language proficiency may weaken in the process. This can potentially deter communication with their non-Burmese speaking family members such as their grandparents, alienate them from their local community, and disassociate them from their cultural heritage. Currently, ethnic languages can serve as the medium of instruction in early childhood, but in primary years, it may only be used in Local Curriculum.

## Exploring Ethnic Language and Culture

Under the revised NEL, Myanmar's monolingual education system was abandoned. National education became defined as "education that values, preserves and develops the language, literature, culture, art, traditions, and historical heritage of all the ethnic groups in the nation and which is able to produce human resources with right holistic thinking and good character, and which can guide and carry out the modern development of the nation according to the needs of the times."[22]

The new stance on national education was manifested with the inclusion of Local Curriculum. Its inclusion is a symbol of the country's moves towards a federal democracy, where the decision-making power on issues, such as educational policy, is distributed between the central government and the local governments of States and Regions. With the new NEL, the rights of ethnic children to learn their mother tongues and their unique local heritages are recognised and ensured. Local Curriculum thus aims to address the needs of Myanmar's linguistically diverse population where a third speak at least one of over 100 different ethnic languages. Around 14% of primary school curriculum will be devoted to ethnic language literacy in the early years, followed by topics specific to the local community and delivered

[22] National Education Law (Unofficial English translation), Parli mentary Law No. 41, Union Parliament of Myanmar, 2014

in the ethnic languages, in the advanced grades. Refer to the basic education primary curriculum Table 1.2 in Unit 1.2 to see how teaching periods for Local Curriculum will be organised for primary level, particularly for Ethnic Languages.

**The importance of learning in the Mother Tongue**

Local Curriculum has created opportunities for some integration of mother-tongue based multilingual education (MTB MLE) practices into the formal education system for the first time. Research has shown that when the language of instruction is not in the students' mother tongue, teachers may resort to teacher-centric approaches towards these students, such as short ended questions and rote memorisation. Due to the students' inability to fluently express themselves in the official language, teachers may refrain from eliciting higher level, abstract thinking.

Helen Pinnock from international NGO Save the Children defines MTB MLE as

"Learner-centred, active basic education which starts in the mother tongue and gradually introduces one or more other languages in a structured manner, linked to children's existing understanding in their first language or mother tongue. Teaching predominantly in the mother tongue for at least six years, alongside the development of other languages, is required for this approach to deliver high quality learning outcomes."[23]

Although the full extent of MTB MLE will not be practiced in schools, such as using students' mother tongue as the language of instruction, the learning theories highlighted below provide some grounds for why teaching ethnic languages can still lead to desirable, positive outcomes. Students are able to comprehend higher order, abstract concepts when it is built on prior knowledge which exist in their mother tongue and concrete learning experiences derived from their local environment. The ethnic language literacy program thus provides students opportunities to develop higher-level thinking and engage with child-centric teaching methods in a way that classes taught in the official language cannot offer initially.

[23] Pinnock, H., & Vijayakumar, G. (2009). Language and education: The missing link. Reading: CfBT Education Trust.

- Developmental learning theory (Piaget): Children learn in predictable stages from very concrete learning experiences to increasingly more complex and abstract concepts.[24]
- Schema theory (Anderson): Children learn new concepts by relating the new to what they already know (their prior knowledge).[25]

Research has also shown that mother tongue education promotes mastery of the official language and builds the students' self-confidenc , self-esteem and strong identity, encouraging increased student classroom engagement and reducing drop-out rates.

**Teaching Ethnic Languages in Practice**

- The Mon Ethnic Committee (MNEC) was the first ethnic organisation to collaborate with the national government (MOE) by providing a three-language education system to Mon ethnic students. In the schools administered by MNEC, children learn subjects in their Mon language at primary level and switch to Burmese as the language of instruction in middle school, learning Mon and English languages as additional subjects. At secondary level, the curriculum becomes similar to that of the public-school system, with Mon and English continued to be taught as supplementary modules. Mon students under this system were able to get access to basic education without the obstacles of learning in an unfamiliar language, preserve their mother tongue, and matriculate into the nationwide higher education system.[26]

- The northern Pwo Karen bilingual education project in Thailand brought together Pwo Karen and Thai teachers with the initiative of creating an alternative learning programme for Pwo Karen children. The minority children had been performing academically below their peers in Thai rural schools that in some cases, they had been placed into programmes for the mentally challenged. The bilingual programme instead encourages the development of the Pwo Karen children's language with educational materials in the Pwo Karen language created and learning activities divided between the two languages. Consequently, a higher learner participation was demonstrated in the programme when compared to Thai rural schools. As a result of experiencing success when acquiring their first language, the children were able to transition to Thai subjects with boosted confidence and success [27]

[24] Malone, D., & Malone, S. (2011). Teacher Education for Mother TongueBased Education Programs. SIL International
[25] Ibid.
[26] Lall, M., & South, A. (2014). Comparing Models of Non-state Ethnic Education in Myanmar: The Mon and Karen National Education Regimes, Journal of Contemporary Asia,44:2, 298-321
[27] UNESCO. (2007). Mother tongue-based literacy programmes: Case studies of good practice in Asia. Bangkok: UNESCO Bangkok.

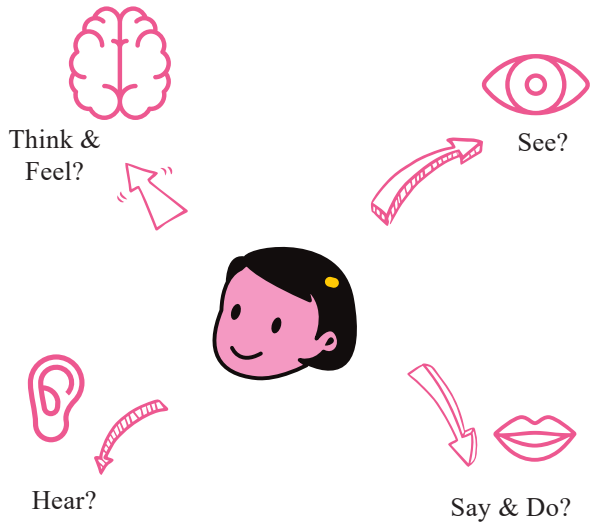
- ASHRAI launched a number of laboratory schools in Bangladesh under the aim of bridging the Oraon children's mother tongue language, Sadri, with the national language, Bengali. The children participated in a Sadri literacy programme, that was inclusively developed with various stakeholders including research team members, community representatives, and education experts. The impact of the programme is exhibited in the students' learning scores that was above their peers from government schools. The impact also extended into the family as parents growingly expressed interest to participate in such programmes when seeing the eagerness and successful ability of their children to learn.[28]

### Learning activity 1

The purpose of this activity is for you to gain deeper insights on the experiences of your students who learn in a language that may not be their mother tongue.

The teacher educator will ask you to consider the benefits and drawbacks of teaching and using only one language in a school where there are ethnically diverse students. You will then empathize with an ethnic minority student and consider their school and life experiences when learning in a language they don't speak at home. You will be asked to provide answers on sticky notes using the question points from the empathy map below. The teacher educator will guide you through the steps of the activity, to collect some insights.

**Figure 2.1. Empathy map**




[28] PIbid

a. Think and feel: What might the students be thinking or feeling before, during, and after school? What do the students tell themselves?
b. Hear: What are they hearing from the people around them, such as their teachers, classmates, family, and community?
c. See: What might the students see happening in the classroom or at home that might affect their learning?
d. Say and do: What are some of the things they say to teachers, classmates, family, and community? What actions and behaviours might you notice about them?

**Learning activity 2**

The purpose of this activity is to give you an understanding of the variety of ethnic language and culture topics that can fall under Local Curriculum. You will develop a greater sense of the country's rich diversity, acknowledging the importance of teaching ethnic languages and cultures in the government school system.

You will be asked to refer to the Local Curriculum Implementation Guide to brainstorm possible topics for this strand, ethnic languages and culture. You will showcase these ideas with an assigned group on an assigned state or division.

**Learning activity 3**

The purpose of this activity is to encourage you to consider the impact of teaching ethnic language and culture on student outcomes with reference to international literature. You will gain a deeper understanding of MTB MLE and identifying the distinct aspects of this education approach.

The teacher educator will have assigned you to read a recommended list of literature prior to class. You will engage in a discussion with an assigned group on the definition of MTB MLE, drawing from your reading. The groups will all share your own definition of MTB MLE in class, and will be asked to pinpoint common keywords re-appearing in all the answers provided. The class then will conclude by getting into a discussion on the academic and social impact of learning in one's mother tongue.

**Review questions**

1. Reflect on your own journey, learning a second language such as English. In reference to the empathy map activity:
   a. What were some of the answers that you resonated with?
   b. Is there anything that did not appear on the empathy map that you experienced when learning a different language?

# 2.2. Supporting Students Learning

This sub-unit will introduce you to some of the difficulties that primary school students may face when learning ethnic languages and the ways that you can support this learning.

## 2.2.1. How to support students learning Ethnic Languages

**Expected learning outcomes**

**By the end of the lesson, you will be able to:**

- Discuss the difficulties primary school children may have in learning ethnic languages and cultures and how the teacher can support them; and
- Explain the importance of collaboration with ethnic language teachers at school and classroom level.

## Challenges to learning Ethnic Languages

Some ethnicities have a wide selection of media and literature produced in their ethnic language with the assistance of a developed writing system and community support. Conversely, there may be some ethnicities where a standardised writing system is lacking and consequently, books produced in their language as well. This can be a barrier to learning ethnic languages when learning materials are inadequate and representation of the language and culture in literature and media that interest the students is limited. Community members qualified to teach ethnic languages may also not have a formal education training, hindering their ability to develop and deliver quality learning content in their language. The perceived status of the minority students' language is also a considerable factor to the success of their mother tongue acquisition. Parents may not initially see the value in their children learning their mother tongue in an academic setting due to the deemed irrelevance of their language in the modern economy where Burmese, English, and other languages are dominantly used. Minority students may be reluctant to excel in their mother tongue to prioritise instead learning the national and international languages.

## The effect of learning Ethnic Languages on other language subjects

There is a substantial body of findings that supports the linkage between minority students' mastery of their mother tongue to academic success in the official language. Works of research suggest encouraging continued learning of the mother tongue enhances rather than inhibits students' proficiency in other languages.

- The threshold hypothesis (Cummins) suggests that a certain level of competence must be achieved in the first language for the learner to successfully become proficient in a second language [29]
- The interdependence hypothesis (Cummins) argues that much of the underlying concepts and skills attained when learning the first language can be transferable to the second language.[30]

[29] O'Connell, J. (2012). Supporting children's mother tongue in our schools. *In Touch.*
[30] Ibid.

The importance of ethnic languages extends beyond preserving students' culture and heritage. According to the hypotheses, strengthening students' proficiency in the mother tongue builds transferable linguistic knowledge and decreases cognitive challenges when learning a second language. Thus, encouraging minority students' ethnic language development can be beneficial for their learning in other subjects where the medium of instruction is Burmese.

**Teacher attitudes towards Ethnic Languages**

School environments that do not value and respect minority languages and cultures may reinforce the misconception that there is no merit in learning ethnic languages. To encourage the minority students' development in their mother tongue, you must take heed of how your words and actions towards minority students and ethnic language teachers convey a positive or negative view of ethnic languages. For instance, gestures such as allowing students to use their mother tongue in class during informal times, showing mutual respect to ethnic language teachers, and accepting them into the wider teacher community all can establish ethnic languages' important place in formal education.

**Importance of collaboration**

As learning ethnic languages can build transferable competencies that aids in the learning of a second language, teacher collaboration opportunities with ethnic language teachers can be considered to further facilitate this transfer. According to research literature, teacher collaboration at the school level leads to improved student outcomes and is manifested as "teachers working together in joint planning, decision making, and problem solving that may occur formally or informally for the purpose of accomplishing a common goal...and meeting student's needs."[31]

Collaboration with the school leadership team, staff, parents, and other community members can also improve acquisition of ethnic languages. This collaborative 'whole school approach' gives the responsibility of the children's mother tongue development to all stakeholders of the school who consider ways to promote student learning beyond the classroom and in relevant aspects of the child's life. For instance, staff members can create and pursue

[31] Mansour, A., & Butler-Kisber, L. (2015). Collaboration between language teachers and instances of cross - language learning transfer. Montreal: McGill University.

strategies in school governance and administration that acknowledges and promotes the language diversity of their student population. Furthermore, it is important that you collaborate with parents to figure out ways to enhance the connection between what the children learn in the classroom and learn at home. For example, when students learn a certain rule of grammar, it can be undermined if it is not being practised at home when they speak with their families.

**Teacher collaboration in Practice**[32]

The 'Similarity in Teaching English and French, Second Language' project investigated the collaboration efforts between English and French language teachers in Canada to develop its bilingual learners. For instance, students would redo their group project for their English class into French and vice versa. Both language teachers would also share with one another the progress of their students' language development and problem areas for thorough insights on the students. The teachers also collaboratively worked on their curriculum so that expectations are uniform and themes or topics were selected that were complementary to what was being taught in the other classes. Besides improved student learning, teachers also saw that the collaborative efforts contributed to their professional development.

**Learning activity 1**

The purpose of this activity is to encourage you to contemplate possible student challenges to learning ethnic languages. You will also use these ideas to complete the next activities.

The teacher educator will ask you to think about possible barriers to ethnic nationality students' learning of their mother tongue. These barriers can exist inside and outside of the classroom. You will be asked to discuss this with partner and share yours and your partner's thoughts on the subject matter.

[32] Ibid.

### Learning activity 2

The purpose of this activity is to encourage student teachers to recognise the value that collaborating with ethnic languages teachers offers to student learning in their own classes. The student teachers will consider a way collaboration assists them in create engaging and effective learning experiences for their students, despite not sharing languages and culture with their students.

A short video, 'Multilingual approaches to teaching and learning'[33] demonstrates how insights of the students' ethnic languages and culture informed the teacher to create lessons that were engaging and relevant to students. You will be introduced to the topic of teacher collaboration and will be asked to consider insights and resources you can share with ethnic language teachers to improve student learning in your class. You will work in groups and present your ideas to the class on a large piece of paper.

### Learning activity 3

The purpose of this activity is to encourage you to review strategies recommended by international literature on teaching to linguistically diverse students. You will consider classroom practices that promotes the students' learning of their ethnic languages as well as collaboration with ethnic language teachers:

You will have been assigned to read the text 'Multilingualism in the classroom', and asked to consider answers to the following list of questions for discussion beforehand.

a. How do you acknowledge and value different languages in class?
b. The text refers to the practice of "translanguaging" that includes "code switching", how can this be used in the classroom by collaborating with ethnic languages and cultures teachers?

The teacher educator will facilitate a discussion on the reading prompts by grouping you in pairs. You can consider the answers, drawing from the assigned text, other texts, or experiences. You or partner will then be asked to share your answers in class.

[33] AITSL. (21 April, 2016). Multilingual approaches to teaching and learning. Retrieved from https://www.youtube.com/watch?v=J16Ruh0OgGA

**Review questions**

1. Construct a list of dos and don’ts you could use to advise other teachers when dealing with ethnic nationality students in light of what has been discussed and covered in the lesson. You are encouraged to share in pairs.

# Unit Summary

**Key messages**

- Local Curriculum allows ethnic languages to be taught in primary school, giving opportunities for MTB MLE practices where students develop their mother tongue and link existing understanding to other languages.

- Research studies demonstrate that encouraging students' mother tongue development leads to positive school outcomes, despite not speaking the language of instruction at home.

- Minority students are still liable to obstacles when learning ethnic language, particularly due to minimal representation of their language in mainstream culture, which can be minimised through inclusive classroom practices.

- Mother tongue development also supports proficiency in other languages and so, collaboration opportunities with the students' ethnic language teachers should be explored for better transfer of linguistic knowledge and skills between languages.

## Unit reflection

This unit has introduced you to the basic concepts around including ethnic language teaching in Local Curriculum and has encouraged you to explore the opportunities and barriers that are presented to students that speak different ethnic languages to the ones that are taught at their primary school.

You have also been introduced to the opportunities for collaboration with ethnic language teachers in reference to theories of bilingualism/multilingualism.

The topics of ethnic language and culture that are to be taught in the relevant regions/states for primary school students was also covered.

What are the limitations of monolingual education?

Why is it important to recognise the importance of learning mother tongue?

You have been introduced to practical elements of teaching ethnic languages at primary school and have been introduced to the Mon Ethnic Committee (MNEC), which was the first ethnic organisation to collaborate with the national government (MoE) by providing a three-language education system to Mon ethnic students.

Finally, you have had the opportunity to explore what students that speak different ethnic language might be thinking or feeling, seeing and hearing before, during, and after school?

What important topics do you think should be considered when teaching ethnic languages in primary school, what barriers are you aware of that can prevent this and how might you overcome them?

## Further reading

**2.1.**

Bühmann, D., & Trudell, B. (2008). *"Mother Tongue Matters, Local Language as a key to Effective Learning."* Paris: UNESCO.

ENAC. (2018). *Mother Tongue-Based Multilingual Education System in a future federal democratic union of Burma.*

Lwin, T. (2011). *Language, Identities and Education: in relation to Myanmar.*

Naing, T. (2016). *Education in a Federal Democracy".* Yangon: Myanmar Knowledge Society, MKS.

Trudell, B., & Young, C. (2016). *Good Answers to Tough Questions in Mother Tongue-Based Multilingual Education.* Dallas: SIL International.

**2.2.**

Cummins, J. (1981). *The role of primary language development in promoting educational success for language minority students.* Los Angeles: California State University Evaluation, Dissemination and Assessment Center.

UNESCO. (2003). *Education In A Multilingual World: UNESCO Education Position Paper.*

# Unit 3

# Agriculture

Myanmar is an agro-based country, and agriculture is the backbone of its economy, contributing to the overall economic growth of the country. About 70% of the total population resides in rural areas, where people are mainly employed in agricultural farming. At present, the agriculture sector in Myanmar is experiencing a knowledge and technology deficit, especially in rural areas. The government is trying to educate the farmers in rural areas to boost Myanmar's agricultural sector. Given the importance of agriculture in Myanmar, agricultural education is a priority. In the process of developing the agricultural sector, the introduction of agricultural lessons in Local Curriculum is crucial to the development of human resources for the next generation. This unit will help you understand and teach basic agricultural science skills as a subject area in primary schools across Myanmar.

## Expected learning outcomes

**By the end of this unit, you will be able to:**

- Explain basic concepts and knowledge of agriculture to be taught to primary school students;
- Demonstrate practical skills of basic agricultural science and plant propagation techniques;
- Explain the importance of plants and classify different plants;
- Demonstrate basic knowledge of seeds and skills of seed germination;
- Identify the importance of soils, basic soil types and soil pH;
- Explain nutrients for plants, different fertiliser types and application methods
- Explain what plant propagation is and how to propagate some plants by the air-layering method;
- Explain what plant propagation is by cutting and propagating some plants by stem cutting methods;
- Recognise the nature of insects, the damage they can cause to crops and methods of control;
- Describe the methods of pest control; and
- Explore modern trends in agriculture.

# 3.1. Plants and Seeds

This sub-unit will introduce the basic different types of plants that are used in agriculture in Myanmar, you will be instructed how to classify them.

## 3.1.1. Plants

**Expected learning outcomes**

**By the end of this lesson, you will be able to:**

- Explain basic concepts and knowledge of agriculture to be taught to primary school students;
- Demonstrate practical skills of basic agricultural science and plant propagation techniques; and
- Explain the importance of plants and classify different plants.

## Where and how do plants live?

Plant life can generally tolerate more adverse conditions than animal life, and plants exist in virtually every liveable environment. Plants have become adapted to a wide range of moisture, drought, heat, and cold. Some flowering plants are found in the hottest and driest sections of the deserts of Libya and Western Australia.

## Importance and uses of plants

Of primary importance to humans are the plants we use as food. The most important of these are cereals or grains. Wheat, corn, rice, barley, rye, oats, millet and sorghum are the main cereals. After cereals in terms of use and importance are legumes, peas, and beans. Vegetables include a wide variety of plants with edible parts. Some, such as the potato, sweet potato, radish and carrot, grow underground. Others such as cabbage, lettuce and celery, are called leafy vegetables. Many kinds of fruit form an important part of humans' diet. The seeds of nuts are used both for food and industrial purposes.

The three essential food groups are carbohydrates (sugars and starches), fats and protein. Carbohydrates are obtained directly from plants; the fats and protein are derived from plants or from animals which feed on plants. Sugars are prepared from corn as well as from sugarcane and sugar-beet. Honey, although produced by bees, is essentially natural sugar collected from flowers. Much of the starch we use is obtained from corn and wheat, although some comes from potatoes, arrowroot, sago palm, rice and cassava. Edible oils (fats) are extracted from olives, corn, soybeans, sesame, and peanuts.

All our spices come from plants. The most familiar of these are pepper, ginger, nutmeg, cloves, and cinnamon. Many herbs such as mint, basil, garlic and lemon grass are used for seasoning. Our beverages, including coffee, tea, cocoa, beer, wine and liquors, are plant products. Furthermore, the use of plants for medicinal purposes is still common around the world.

Additional plant products that are very important are the fibres obtained from cotton, jute, hemp and flax. Many are also the direct products of the forest, from which we obtain not only lumber but also turpentine, gums, resins, waxes, rubber and cork. Finally, the aesthetic value of plants cannot be ignored when considering their utility to humans. The fields and forests act as places to retreat and where peace and contentment are enjoyed by many people. Also, the beauty of plants is responsible for industry involving seedsmen, horticulturists, nurserymen, landscape gardeners and florists. Pleasure is provided by the enjoyment of plants in lawns, parks, streets, botanical gardens, conservatories, golf courses, and even cemeteries. Aside from the large amount of money spent each year on ornamental plants, there is a value in seeing and growing them that cannot be measured in monetary terms.

**How are plants classified?**

**Classification based upon the length of the life of the entire plant**

- **Woody Plants:** Trees and shrubs that have shoots that live for a number of years.
- **Herbaceous Plants:** Plants in which the aerial portion is relatively short-lived and the tissues comparatively soft.

**Classification based on seasonal growth**

- **Annuals:** Plants that complete their life cycle, seed – plant – seed during a single season. They are normally herbaceous. Examples: corn, rice, wheat, and pulses.
- **Biennials:** Plants that require two years to complete their life cycle. They are normally herbaceous. Examples: carrot, cabbage, cauliflower and onions.
- **Perennials:** Plants that are long-lived, more than two years and are usually woody or herbaceous. Examples: rose, lilies, mango, apple, coconut.

**Learning activity 1**

Using the information provided in this unit, undertake some research to develop a list of crops that are grown in Myanmar could be classified as either annual, biennial or perennial.

# 3.1.2. Seeds

**Expected learning outcomes**

**By the end of the lesson, you will be able to:**

- Demonstrate basic knowledge of seeds and skills of seed germination.

**What is a seed?**

A seed is a unique element of life that consists of an embryo with nourishing and protecting tissue. The embryo is a miniature plant. The principal parts are the plumule, radicle, hypocotyl, epicotyl, and cotyledons. The plumule is the first growing point of the stem; the radicle is the first growing point of the root; and the hypocotyl and epicotyl together constitute the first or original stem of the plant

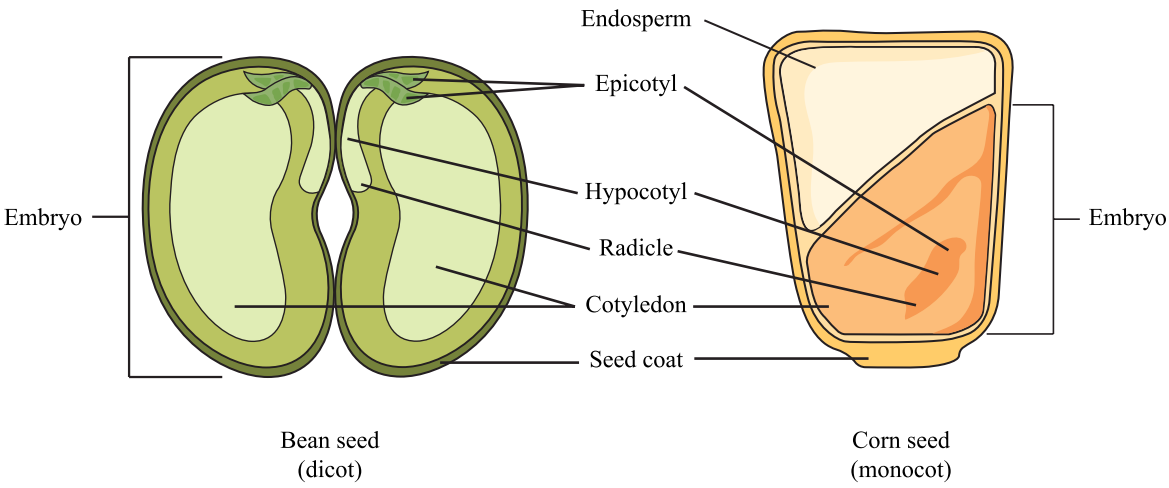
The nourishing tissues are endosperm or cotyledons. In well-developed mature seed, these tissues are packed with stored food such as starch, hemicellulose, reserve proteins or fats depending on the kind of plant. For example, sweet corn stores starch, asparagus and onion store hemicellulose, peas and beans store reserve proteins and carbohydrates, and lettuce, okra and cucurbits store large quantities of fat.

The protecting tissue is the seed coat. It slows down the rate of transpiration and protects the delicate embryo from mechanical injury to some extent. The seed coat consists of two layers; the outer thick one, named the testa, and the inner membranous one, named the tegmen. A scar known as the hilum is found on one part of the seed and is the point where the seed is attached to the fruit. Just above the hilum is a minute pore, the micropyle. Water and air enter the seed through this opening during germination.

Seeds can be divided into two major classifications, monocots (monocotyledons) and dicots (dicotyledons), based on the number of cotyledons (seed leaves) in a seed. Monocots contain one cotyledon, whereas dicots have two.

Examples of plant species having monocot seeds are grasses – such as small grains, corn, or turf grasses – and other crops such as onions. Plants with dicot seeds include legumes – such as peas, peanuts, soybeans, and clover – and other crops such as cotton and tobacco.

**Figure 3.1. Structure of a seed**




## Why are seeds important?

Seeds are an excellent source of protein, vitamins, minerals, fibre, fats and calories for humans from a nutritional point of view. Agriculturally, seeds are a propagating material used for sowing or planting purposes.

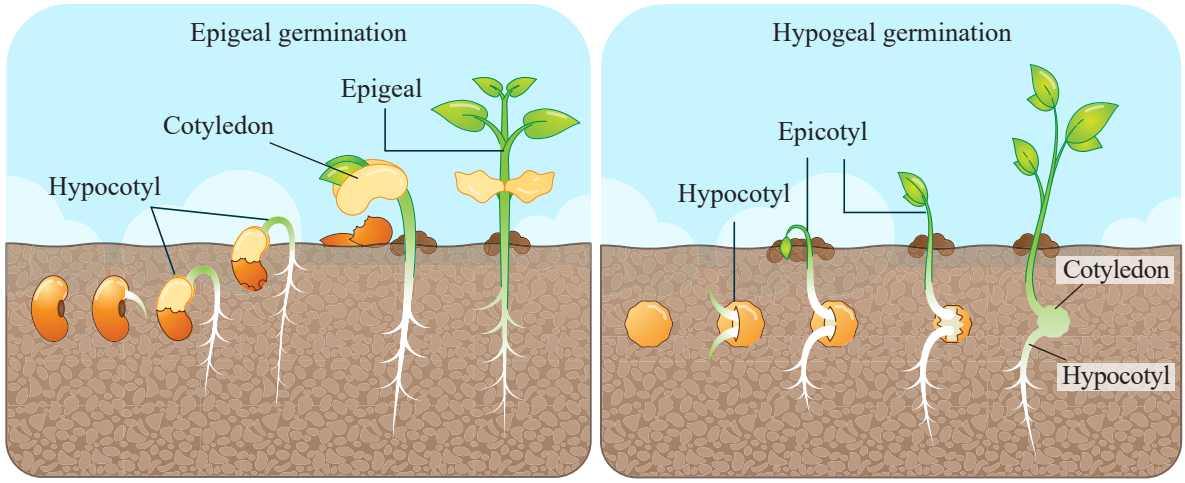
## How are seeds formed?

Seed formation begins with the combination of a male and female gamete through pollination and fertilisation. Pollination is the placement or transfer of pollen from the anther to the stigma of the same flower or another flower. Upon transfer, the pollen germinates to form the pollen tube and the sperm for fertilising the egg. Pollination takes two forms: self-pollination and cross-pollination. Self-pollination occurs when the pollen from the anther is deposited on the stigma of the same flower, or of another flower on the same plant. Cross-pollination is the transfer of pollen from the anther of one flower to the stigma of another flower on a different individual of the same species. Pollination is done by insects, birds, bats, water and wind.

## How do seeds germinate?

Germination is the process of seeds developing into new plants. As germination occurs, the growing parts of the radicle and plumule divide rather rapidly. Usually, the radicle emerges from the seed coat first, proceeds downward, and develops into the root system. The plumule then proceeds upward and develops into the shoot system. There are two types of germination: epigeal germination (e.g. beans, mustard, cabbage, tomato) and hypogeal germination (e.g. peas, mango).

**Figure 3.2. Types of germination**




The following three conditions are necessary for seeds to germinate:

- The embryo must be alive and capable of germination;
- The embryo must be non-dormant; and
- The seeds must be subjected to favourable environmental conditions (water, temperature, aeration, light).

## Types of seed

### Table 3.1. Types of seed

| Orthodox Seeds | Recalcitrant Seeds |
|---|---|
| Long-lived seeds | Short-lived seeds |
| Can be successfully dried to moisture content as low as 5% without injury | Cannot be dried to moisture content below 20-30% without injury |
| Able to tolerate freezing | Unable to tolerate freezing |
| Desiccation tolerant seeds | Desiccation sensitive seeds |
| Ex situ conservation is not problematic | Ex situ conservation is problematic |
| Examples: cereals, grains, most horticultural crops | Examples: Mango, coconut, lychee, mangosteen, rambutan, avocado, durian, jackfruit, rubber, tea |

### Learning activity 1

In your classroom learning on this lesson, you will be asked by your teacher educator to germinate a number of seeds in a germinating tray. These seeds will take some time to germinate, so this will not happen during the course of the lesson, however you must follow the instructions of your teacher educator in observing the germination process and providing support to the seeds where necessary.

### Review questions

1. Think of the different classifications of plants that you have learned about in this unit; how does this information relate to your own knowledge of plants that grow in and around the environment you are from?
2. Consider the information you have learned on the different types of seed and the experience you have had germinating those seeds. What plants can you grow from seed in the environment that you live in? What will ensure that those seeds grow successfully?

# 3.2. Soils and Fertilisers

This sub-unit will introduce you to the importance of soil in the propagation of plants and also provides a basic explanation of the differences between certain soils, how the soil is made up and why different soils are more suitable for different plants.

## 3.2.1. Soils

**Expected learning outcomes**

**By the end of the lesson, you will be able to:**

- Identify the importance of soils, basic soil types and soil pH.

**What is Soil?**

Soils are complex mixtures of minerals, water, air, organic matter, and countless organisms that are the decaying remains of once living things. Soil forms at the surface of land and is capable of supporting plant life, and is vital to life on earth.

**What do soils do for us?**

There are a wide variety of different soils around the world, providing a range of environmental, economic and social benefits to the local human population. Soil performs many critical functions in almost any ecosystem. The following are general roles that soils play:

- Soils serve as media for growth of all kinds of plants;
- Soils modify the atmosphere by emitting and absorbing gases (carbon dioxide, methane, water vapour, and others) and dust;

- Soils provide a habitat for animals that live in the soil such as groundhogs and mice, and organisms (such as bacteria and fungi), that account for most of the living things on Earth;
- Soils absorb, hold, release, alter, and purify most of the water in terrestrial systems;
- Soils process recycled nutrients, including carbon, so that living things can use them over and over again;
- Soils serve as an engineering media for the construction of foundations, roadbeds, dams and buildings, and preserve or destroy artefacts of human endeavours;
- Soils act as a living filter to clean water before it moves into an aquifer
- Soils make a substantial contribution to biodiversity; and
- Soil is essentially a non-renewable resource.

**Topsoil and Subsoil**

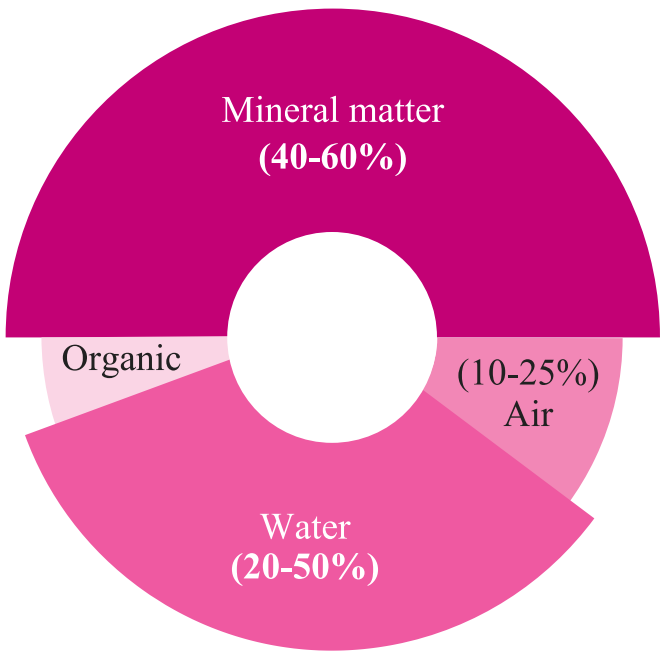
Topsoil, which is found near the surface, is the main arena of root development. It carries much of the nutrients available to plants, and it supplies a large share of the water used by crops. Also, as the layer of soil that is ploughed and cultivated, topsoil is subject to manipulation and management. By proper cultivation and the incorporation of organic residues, its physical condition may be modified. It can be treated easily with chemical fertilisers and limestone, and it can be drained. In short, its fertility and productivity may be raised, lowered or satisfactorily stabilised at levels consistent with economic crop production. Ploughing, liming and fertilisation are applied essentially to the furrow slice. In practice, the term “soil” usually denotes the surface layer, the “topsoil”, or the furrow slice.

Even though the subsoil cannot be seen from the surface, there are few land uses that are not influenced by subsoil characteristics. Crop production is certainly affected by root penetration into the subsoil and by the reservoir of moisture and nutrients held inside. Likewise, the selection of building sites and the location of roadways are influenced by subsoil characteristics. These observations are of practical significance since, unlike the topsoil, the subsoil is subject to little human alteration except by drainage. Consequently, land-use decisions are often more dependent on the nature of the subsoil than on topsoil characteristics.

## Components of the soil

A combination of physical, chemical and biotic forces act on organic materials and weathered rock to produce a soil with a porous fabric that retains water and gases. The mineral matter derived from weathered rock consists of particles of different sizes, ranging from clay (the smallest), to silt, sand, gravel, stones, and in some cases, boulders. Soil water contains dissolved organic and inorganic solutes and is called the soil solution. While the soil air consists primarily of $N_2$ and oxygen ($O_2$), it usually contains higher concentrations of carbon dioxide ($CO_2$) than the atmosphere, and traces of other gases that are by-products of microbial metabolism. The relative proportions of the four major components – mineral matter, organic matter, water and air – may vary widely.

**Figure 3.3. Proportions of the main soil component by volume**




## Soil texture

The inorganic material in soil is called mineral matter. Mineral matter began as rock that was weathered into small particles. Most soils have different sizes of mineral particles. These particles are labelled sand, silt or clay, based on their size.

**Sand** is the largest of the mineral particles (2.0 – 0.05 mm). Sand particles create large pore spaces that improve aeration. Water flows through the large pore spaces quickly. Soils with a high percentage of sand are generally well drained. Sandy soils lack the ability to hold nutrients and are not fertile. Sandy soils also feel gritty when touched.

**Silt** is the mid-size soil particle (0.05 – 0.002 mm). Silt has good water-holding ability and good fertility characteristics. It feels like flour when dry, and smooth like velvet when moist.

**Clay** is the smallest size soil particle (less than 0.002 mm). Clay has the ability to hold both nutrients and water that can be used by plants. It creates very small pore spaces, resulting in poor aeration and poor water drainage. Clay forms hard clumps when dry and is sticky when wet.

Soils with large percentages of sand are easier to work with than soils with large percentages of clay. Clay soils tend to be tighter, making them more difficult to break up or cultivate, whereas sandy soils are looser. A clay soil also takes longer than a sandy soil to dry after a rain. Because of the better drainage, a sandy soil can be worked sooner. With a wet clay soil, the producer or gardener must wait longer for the soil to dry sufficiently. Soil texture may limit the crops that can be grown. For example, root crops, such as carrots and onions, perform best in a sandy soil because it is loose and allows the plants to expand. On the other hand, some crops may experience stunted growth in a sandy soil because the soil lacks water- and nutrient-holding ability.

### Characteristics of Sand, Silt and Clay

### Table 3.2. Characteristics of sand, silt and clay

| Characteristics | Sand | Silt | Clay |
|---|---|---|---|
| Looseness | Good | Fair | Poor |
| Air space | Good | Fair to good | Poor |
| Drainage | Good | Fair to good | Poor |
| Tendency to form clods | Poor | Fair | Good |
| Ease of working | Good | Fair to good | Poor |
| Moisture holding capacity | Poor | Fair to good | Good |
| Fertility | Poor | Fair to good | Fair to good |

## Soil pH

Soil pH is a measurement of the acidity or alkalinity of a soil. On the pH scale, 7.0 is neutral. Below 7.0 is acidic and above 7.0 is basic or alkaline. The quality of irrigation water used can also have an effect on soil pH. Areas with limited rainfall typically have alkaline soils while areas with higher rainfall typically have acid soils. Soil pH is important to growers because it can affect the availability of plant nutrients as well as the soil ecology. In very acid or alkaline soils, some plant nutrients convert to forms that are more difficult for plants to absorb. This can result in nutrient deficiencies. The ideal soil pH range for growth of most plants is between 5.0 and 7.5. Soil pH can be easily and roughly determined using a portable soil pH tester.

**Figure 3.4. The pH scale**

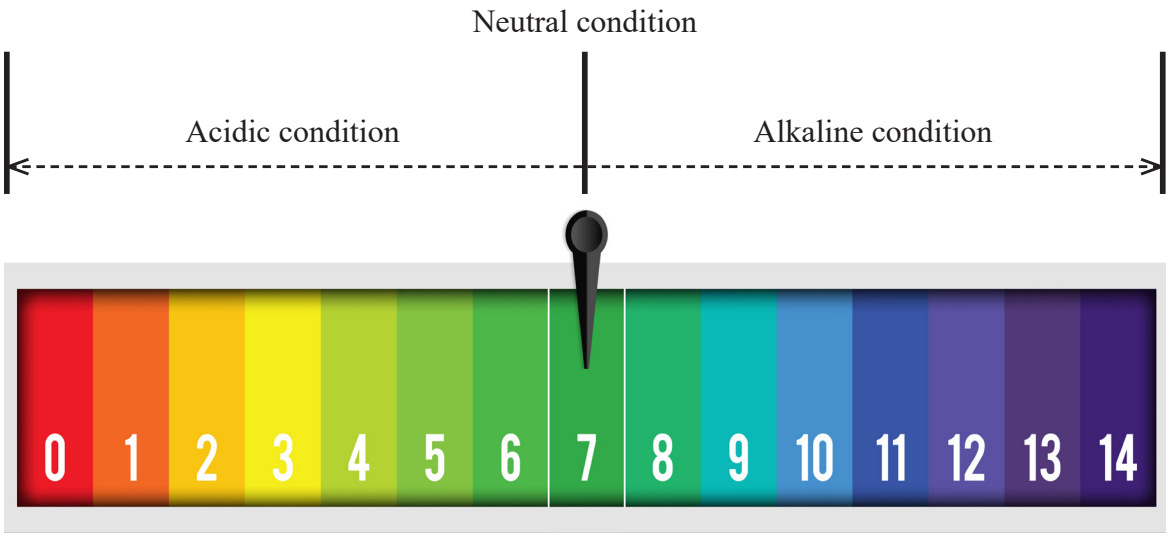


**Figure 3.5. A portable pH tester**


## Suitable pH range of important crops in Myanmar

**Table 3.3. Suitable pH range of important crops in Myanmar**

| Crops | Suitable pH range |
|---|---|
| Rice | 5.5-7.5 |
| Maize and wheat | 6-7 |
| Sugarcane | 6-8 |
| Cotton | 5-7 |
| Groundnut | 5-6 |
| Legumes | 6-8 |
| Cabbage | 6-7 |
| Cauliflowe | 6-8 |
| Tomato and eggplant | 6-7 |
| Cucurbits | 6-8 |
| Potato | 5-6 |
| Citrus | 5-7 |

### Learning activity 1

Discuss with your peers about the types of crops that are grown near to the Education College, or near to the place where you are originally from. What crops can you list, and what can you determine about the soil in that area?

# 3.2.2. Fertilisers

**Expected learning outcomes**

**By the end of the lesson, you will be able to:**

- Explain nutrients for plants, different fertiliser types and application methods.

## What nutrients (elements) are required for the growth of plants?

There are 16 elements necessary for normal plant growth, presented in full in Annex 1. The most important four elements that are considered major nutrients are introduced below.

**Table 3.4. Chemical elements necessary for normal plant growth**

| No. | Element (Nutrient) | Chemical Symbol | Major Functions in Plants |
|---|---|---|---|
| 1. | Nitrogen | N | It is for strong, vigorous growth, good leaf colour, and photosynthesis. |
| 2. | Phosphorus | P | It promotes root development, flower blooming, ripening of seeds and fruits. |
| 3. | Potassium | K | It improves the overall health of plants. It helps them withstand very hot or cold weather, defend themselves against diseases, helps fruit formation, photosynthesis, and the intake of other nutrients. |
| 4. | Calcium | Ca | It promotes plant vigour, good growth of young roots and shoots, and helps to build cell walls. |

Nitrogen, phosphorus and potassium are regarded as major nutrients for plants. Additional nutrients include: Calcium, magnesium and sulphur which are considered secondary nutrients. Boron, chlorine, copper, iron, manganese, molybdenum, and zinc are micronutrients or minor/trace elements.

## How plants obtain nutrients

Plants obtain oxygen, hydrogen, carbon and nitrogen from water and the air. Nitrogen from the air is used by legume plants through the aid of bacteria working in the nodules on their roots. Carbon and oxygen from the air enter the leaves as carbon dioxide, which is produced in the decay and burning of organic matter and coal, in many simple chemical reactions, and in many of the important life processes of animals. Hydrogen comes largely, if not wholly, from water. Nitrogen, phosphorus, potassium, calcium, magnesium, sulphur, iron, manganese, boron, zinc, and copper are obtained by plants through their roots from the soil. In general, plants obtain all of the carbon, oxygen, and hydrogen needed for complete development, except hydrogen during drought. Usually, it is the lack of nitrogen or of one or more of the mineral elements that limits crop growth.

## What is fertiliser?

Fertilisers are the common names of substances or compounds containing one or more essential mineral nutrients that are applied to the soil and sprayed on the leaves for the purpose of providing nutrients to the plant.

## Types of fertilisers

Fertilisers can be mainly categorised into two groups: inorganic fertilisers and organic fertilisers.

## Inorganic fertilisers (chemical fertilisers)

Inorganic fertilisers are chemical fertilisers in the form of mineral salts produced by industrial processes that are applied to plants.

Inorganic fertilisers can be divided into four types:

1. **Single element fertiliser**
    - Nitrogen (N) source only (e.g. urea fertiliser: 46% N)
    - Phosphorus (P) source only (e.g. T-super fertiliser: 52% $P_2O_5$)
    - Potassium (K) fertiliser only (e.g. muriate of potash fertiliser: 62% $K_2O$)

**2. Complete fertiliser**

A complete fertiliser is a fertiliser blend or mix that contains the three main plant nutrients: nitrogen (N), phosphorus (P), and potassium (K), in the forms of potash, phosphoric acid, and nitrogen. Examples:

- 15:15:15
- 10:10:15
- 15:10:10

**3. Compound fertiliser**

A compound fertiliser is a fertiliser that contains the three main plant nutrients: N, P, K mixed with trace elements.

- 15:15:15 + trace elements

**4. Complex fertiliser**

A complex fertiliser is referred to a fertiliser with two nutrients of the three main plant nutrients (N:P:K). Sometimes it is added with trace elements.

- 26:13:0
- 18:46:0 + trace element

**Advantages of chemical fertilisers**

- Since nutrients are immediately available to the plants, changes occur in days.
- They are highly analysed to produce the exact ratio of nutrients desired.
- Standardised labelling makes ratios and chemical sources easy to understand.

**Disadvantages of chemical fertiliser**

- Chemical fertilisers are primarily made from non-renewable sources, including fossil fuels.
- They grow plants but do nothing to sustain the soil.
- Because the nutrients are readily available, there is a danger of over fertilisation. This not only can kill plants, but can also upset the entire ecosystem.
- Chemical fertilisers tend to leach, or filter away from the plants, requiring additional applications.

- Repeated applications may result in a toxic build-up of chemicals such as arsenic, cadmium, and uranium in the soil.
- Long-term use of chemical fertiliser can change the soil pH, upset beneficial microbial ecosystems, increase pests, and even contribute to the release of greenhouse gases.

**Organic fertilisers**

Organic fertilisers are organic compounds used in agricultural cultivation derived from organic matter, plant debris, kitchen waste, livestock waste, etc.

Organic fertilisers can be classified into two groups

- Traditional organic fertilisers (e.g. manure, compost, organic garbage, green manure); and
- Industrial organic fertilisers.

**Advantages of organic fertiliser**

- Organic fertilisers improve the structure of the soil and increase its ability to hold water and nutrients.
- Since they are the ultimate slow-release fertilisers, it's very difficult to over fertilise (and harm) your plants.
- There's little to no risk of toxic build-up of chemicals and salts that can be deadly to plants.
- Organic fertilisers are renewable, biodegradable, sustainable, and environmentally friendly.

**Disadvantages of organic fertiliser**

- Microorganisms are required to break down organic fertilisers and release nutrients into the soil. Since they need warmth and moisture to do their job, the effectiveness of organic fertiliser is limited to warmer seasons.
- Organic fertilisers break down naturally, so they may not release nutrients as soon as we need them.
- Nutrient ratios are often unknown, and the overall percentage is lower than chemical fertilisers. However, some organic products are actually higher in certain nutrients.

## Forms of fertilisers

Fertilisers can be classified based on their physical forms. There are three main types: granules, powder and liquid.

**Figure 3.6. Forms of fertilisers**

Granules

Powder

Liquid

## Fertiliser Application methods

### Broadcasting

- This refers to spreading fertilisers uniformly over the field.
- Suitable for crops with dense stand, the plant roots permeate the whole volume of the soil, large doses of fertiliser are applied and insoluble phosphorus fertilisers such as rock phosphate are used.

### Placement

- This refers to the placement of fertilisers in soil at a specific place, with or without reference to the position of the seed.
- Placement of fertilisers is normally recommended when the quantity of fertilisers to apply is small, development of the root system is poor, soil has a low level of fertility, and when applying phosphorus and potassium fertiliser.

### Foliar application

- This refers to the spraying of fertiliser solutions containing one or more nutrients on the foliage of growing plants.
- Several nutrient elements are readily absorbed by leaves when nutrients are dissolved in water and sprayed on the leaves.
- The concentration of the spray solution has to be controlled, otherwise serious damage may occur due to scorching of the leaves.
- Foliar application is effective for the application of minor nutrients such as iron, copper, boron, zinc and manganese. Sometimes insecticides are also applied along with fertilisers.

**Figure 3.7. Fertiliser application methods**

Broadcasting method | Placement method | Foliar method

### Learning activity 1

Carry out some further research into the different types of fertiliser, their uses and the reasons why they are used. You could investigate in the internet, or talk to farmers, and chemical suppliers. Try also to find out why certain methods of application are more suitable for certain plants.

### Review questions

1. Why is fertiliser required to grow plants?
2. What are determining factors that influence which fertiliser to use

# 3.3. Plant Propagation

This sub-unit introduces you to the process of increasing the number of plants through the either sexual or asexual propagation. The unit explains the different ways of carrying out propagation naturally or artificially and explains in detail the process of air layering.

## 3.3.1. Understanding the propagation of plants

**Expected learning outcomes**

**By the end of the lesson, you will be able to:**

- Explain what plant propagation is and how to propagate some plants by the air-layering method.

**What is plant propagation?**

Plant propagation means increasing the number of plants, multiplying the plants, or reproducing the plants which are useful for human beings, and preserving their unique characteristics.

## Types of plant propagation

- Sexual or seed propagation.
- Asexual or vegetative propagation.

## Sexual or seed propagation

Sexual propagation is a mean of increasing the number of plants through seeds. It is the most common method of plant propagation widely found in nature and is also universally practiced in agriculture.

## Asexual or vegetative propagation

Asexual propagation means increasing the number of plants through vegetative parts. There are two means of asexual propagation: natural means and artificial means

## Natural means of asexual propagation

- Runners (e.g. strawberry)
- Stolons (e.g. some bamboo, mint)
- Suckers (e.g. banana)
- Bulbs (e.g. onion)
- Corms (e.g. gladiolus)
- Rhizome (e.g. ginger)
- Offshoot (e.g. orchid, snake plant)
- Tubers (e.g. potato)
- Crown (e.g. pineapple)
- Pseudobulb (e.g. orchid).

## Artificial means of asexual propagation

- Propagation by cutting
- Propagation by layering
- Propagation by budding
- Propagation by grafting
- Propagation by tissue culture

# Plant propagation by air-laying method

**What is air-layering?**

Air-layering is a method of plant propagation in which roots are induced to form the aerial part of a plant by making some injury (girdling, slitting at an angle, etc.) to the branch and then enclosing the wound with a moist rooting medium. This method has been practised for more than a thousand years.

Air-layering is used to propagate a number of tropical and subtropical trees and shrubs. In Myanmar, fruit trees such as lychee, citrus, star apple, rambutan, custard apple, hog plum, sapota and guava; and ornamental plants such as rose, hibiscus, croton, gardenia, ficus, ixora, oleander and bougainvillea are common examples of plants propagated by this method. An extra income can be realised by implementing air-layers on the branches before pruning a plant.

**Figure 3.8. Propagation of guava by air-layering method**

**Advantages of air-layering**

- It is an economical method of propagation.
- It has more chances for rooting being supported by the parent plant.
- It is more effective for certain plants which will not root easily by cutting.
- A larger plant can be produced in a shorter time than a cutting.
- It can be done throughout the whole year if adequate moisture can be supplied.

**Time of air-layering**

Rainy season (July to August) is the most successful period for propagating the plants.

**Step-by-step procedures for air-layering**

Air-layering can be performed in the following way:

- Select a healthy and vigorous branch of 0.5-2cm in thickness;
- Remove all leaves and side branches at the region of the branch 30-60cm from the tip;
- Girdle the stem by removing a strip of bark 1-2.5cm completely around the stem;
- Scrape the exposed surface to ensure complete removal of phloem and cambium to avoid premature healing;
- Place a handful of the medium to enclose the cut area, especially the upper edge of the cut, which is the point from which new roots come out;
- Then cover with the sheet of plastic. Make sure to keep the medium moist and to secure a tight seal where the two ends of the sheet join; and
- Support should be given if the weight of the air layers is too much for the branch.

**Figure 3.9. Step-by-step procedures for air-layering**

- Cut the layer from the mother plant below the plastic with sharp clippers when the roots are visible through the medium.
- Remove the plastic.
- Plant it in a container using a good potting mixture or plant it in a well- prepared soil bed without disturbing the roots or removing the ball of medium.
- Shorten the stem that remains in the original pot to a height at which you want new branching to begin.

**Causes of unsuccessful layering**

- Weather too dry
- Medium too wet
- Medium too dry
- Wood too old
- Too much induced injury
- Wrong plant
- Wrong techniques, e.g. trace of cambium left, exposure of treated portion to light.

**Learning activity 1**

Take a moment to consider the different reasons why air-layering may be unsuccessful and try to come up with a list of ways to overcome or prevent the likelihood of an unsuccessful graft. Discuss your findings with your peers to share ideas

# Plant propagation by cutting

**Expected learning outcomes**

**By the end of the lesson, you will be able to:**

- Explain what plant propagation is by cutting and propagating some plants by stem cutting methods.

**What is cutting?**

Cutting is one of the asexual propagation techniques in which a portion of a stem, root, or leaf cut from the parent plant is placed under favourable environmental conditions and induced to form roots and shoots, thus producing a new independent plant. This is the most widely used method of propagating ornamental shrubs such as oleander, croton, hibiscus, etc. and some other fruiting plants such as grape, citrus, drumstick, etc.

**Advantages of cutting**

- Many new plants can be started in a limited space from a few stock plants.
- It is inexpensive, rapid, and simple.
- It does not require any special skill in grafting or budding.
- There is no problem of stock-scion compatibility.
- The parent plant is usually reproduced exactly with no genetic changes.

**Selection of stock plant**

- Grown in full sunlight
- Free from serious diseases
- Moderately vigorous, but not overly vigorous growth
- Productive, but not excessive fruiting
- Free from stress.

### Rooting medium for cuttings

- Organic media such as peat and coarse mineral media such as vermiculite and coarse sand.

### Types of cuttings

- Stem cuttings
- Leaf cuttings
- Leaf-bud cuttings
- Root cuttings.

### Stem cuttings

Stem cuttings can be divided into four groups according to the maturity of wood:

- Hardwood stem cuttings
- Semi-hardwood stem cuttings
- Softwood stem cuttings
- Herbaceous or succulent stem cuttings.

The type of wood can be easily recognised based on the following characteristics:

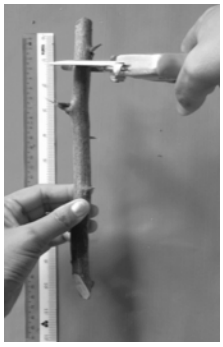
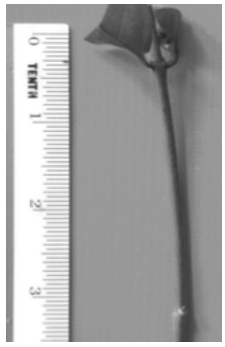
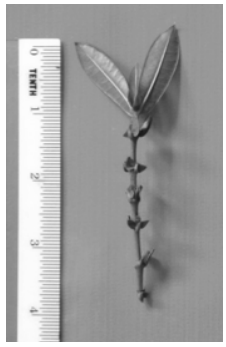
### Table 3.5. Characteristics of wood

| Criteria | Hardwood | Semi-hardwood | Softwood | Herbaceous |
|---|---|---|---|---|
| **Bark colour** | Brown | Light spots, streaks and brown patches | Green | Green |
| **Circumference** | Circular | Circular | Sometimes angular | Normally angular |
| **Presence of leaf** | Nearly always absent | Usually absent | Usually present | Always present |
| **Hardness** | Very hard, difficul to bend | Hard, not easy to bend | Not very difficult t bend | Easy to bend |

## Preparing stem cuttings

The cuttings should contain at least two nodes: one for rooting and another for shooting. The cuttings are made straight by giving a slanting cut at the opposite side of the lowest bud and another cut perpendicular to the axis and 1-2.5cm inch above the uppermost bud. The different cuts make it easy to identify polarity of the cuttings. The bottom-slanting cut permits more rooting area and easy penetration into the medium and the top cut reduces the infection and transpiration rate. The portion above the uppermost bud stands as a barrier if any infection might occur.

### Table 3.6. Preparing stem cuttings

| | Hardwood | Semi-hardwood | Softwood | Herbaceous |
|---|---|---|---|---|
| **Plant examples** | Grape, rose, mulberry, drumstick, pomegranate, fig bougainvillea etc. | Camellia, hibiscus, oleander, rose, croton, bougainvillea, citrus, grape, etc. | Oleander, jasmine, trumpet vine, forget-me-not, garlic vine, ixora, etc. | Geranium, chrysanthemum, coleus, carnation, lavender, cacti,etc. |
| **Selection of wood type** | Taken from a year-old wood or previous season's growth with 0.5-1.25cm thickness | Taken from new shoots | Taken from soft, succulent and new growth of plants | Taken from soft, succulent and new growth of plants |
| **Cutting length** | 15-20cm in length | 8-15cm in length | Usually 8-13cm inches in length | 8-10cm long including terminal bud |
| **Remarks** | - | - | Retain two to four leaves at the upper end and remove lower leaves | No need to cut upper end. Retains original shoots itself. However, remove lower leaves |
| **Methods** |  |  |  |  |

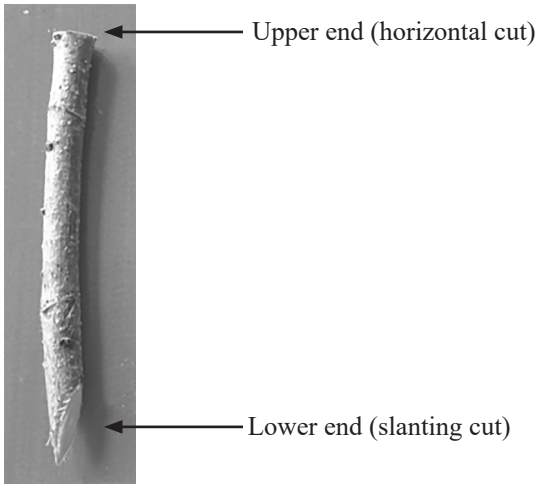
Stem cuttings method is the most commonly used to produce houseplants. Select vigorous, new growths that have no flower buds. A stem section should be free of disease and insects. Each stem cutting should be 5-10cm long and have two or three leaves attached.

Numerous plant species are propagated by stem cuttings. Some can be taken at any time of the year, but stem cuttings of many woody plants must be taken in the dormant season.

**Rooting medium and insertion of cuttings**

Insert cuttings into a rooting medium, such as coarse sand, vermiculite, soil, water or a mixture of peat and perlite. It is important to choose the correct rooting medium to get optimum rooting in the shortest time. In general, the rooting medium should be sterile, low in fertility, drain well enough to provide oxygen and retain enough moisture to prevent water stress. Pure quartz sand is generally used as a rooting medium as it permits good drainage and aeration. Clean sharp plaster sand is most satisfactory for this purpose. Sand beds 13-20cm deep should be used for mass production. Moisten the medium before inserting cuttings and keep it evenly moist while cuttings are rooting and forming new shoots. Cuttings should be inserted into the medium burying three-quarters of their length at an angle of 45°. Burying that deep will prevent the cuttings from early drying out. Place stem and leaf cuttings in bright but indirect sunlight. Root cuttings can be kept in the dark until new shoots appear.

**Figure 3.10. Insertion method**



## Learning activity 1

Based on the instructions and images used in this lesson draw in your notebook, the different types of cutting used in propagation. Research the methods that are not explained in detail in this textbook and draw diagrams for those also. Compare your drawings with your peers.

## Review questions

1. Why must the correct rooting medium be selected?
2. Why should a cutting contain at least two nodes?
3. What are the advantages of using cutting as a propagation method?

# 3.4. Insect Pests, Diseases and Methods of Control

This sub-unit introduces you to the subject of insect pests. You will learn about the benefits that insects bring to plants, but also the damage that insects can cause to plants. Cultural, chemical and biological methods of pest control will be introduced. As this unit only contains one lesson, an alternative lesson on plant diseases that harm plants is presented in Annex 2. This lesson may be covered instead by your teacher educator and you may have the opportunity to learn about the symptoms of disease and the different types of disease control available, including cultural, chemical and physical control.

## 3.4.1. Insect pests and methods of control

**Expected learning outcomes**

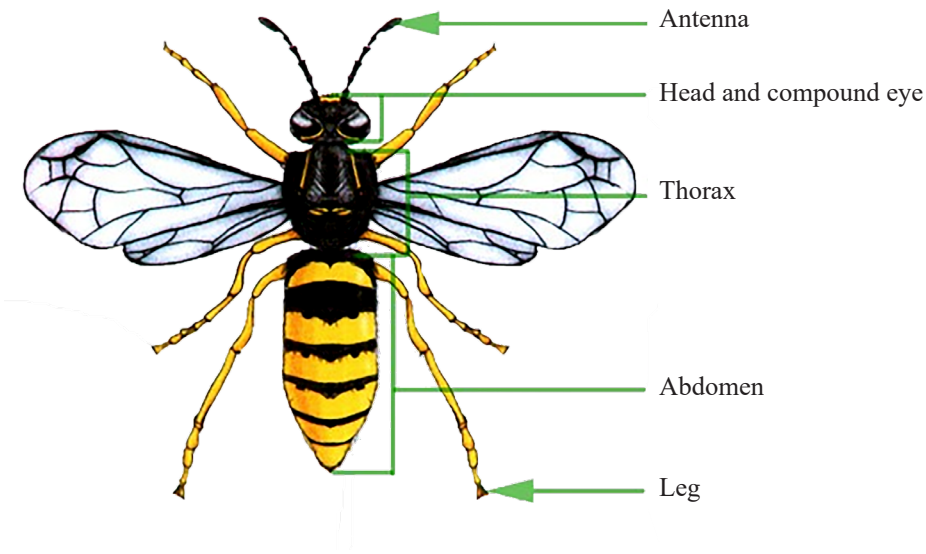
**By the end of the lesson, you will be able to:**

- Recognise the nature of insects, and the damage they can cause to crops;
- Describe the methods of pest control; and
- Explore modern trends in agriculture.

## What is an insect?

An insect is a small arthropod that has six legs, a segmented body divided into three regions (head, thorax, and abdomen), one pair of antennae, and usually has wings.

**Figure 3.11. Anatomy of an insect**

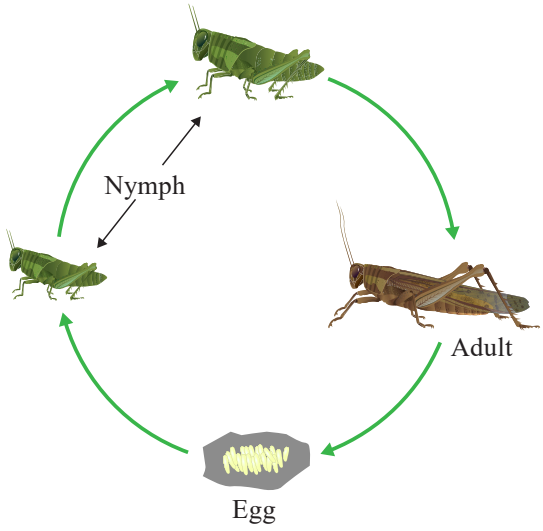



## Life cycle of insects

Insects go through a series of changes during their development, from egg to adult in a process called metamorphosis. When the insect hatches from an egg, it is either a nymph (gradual metamorphosis) or a larva (complete metamorphosis). The immature stage must shed its external skeleton, a process called moulting, in order to grow.

Grasshoppers undergo gradual metamorphosis, passing through three stages of development: egg, nymph, and adult. Nymphs resemble adults. They eat the same food and live in the same environment. The change in form from nymph to adult is gradual. Only the adult form has wings. Other examples are aphids, stink bugs, and leafhoppers.

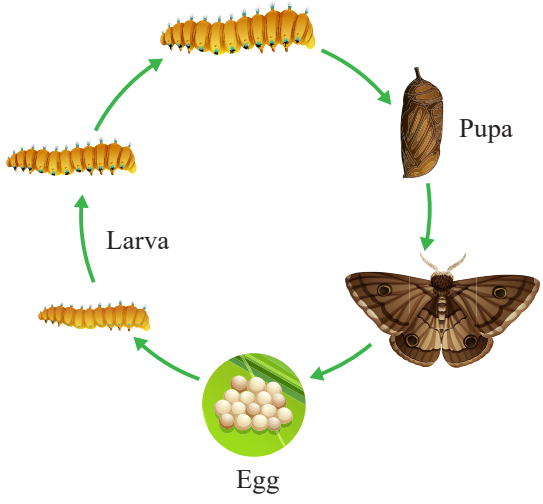
**Figure 3.12. Life cycle of grasshopper**




Insects with complete metamorphosis include butterflies and moths, beetles, flies, bees, and ants. There are four stages in complete metamorphosis – egg, larva, pupa, and adult. The larvae are specialised for feeding and look very different from the adult. They have general names such as caterpillar, maggot, white grub, or wireworm. Larvae usually live in very different situations and often feed on different foods than the adults.

A variety of insects and mites can attack plants, but most are not pests. Some are beneficial, providing natural control or pollination services. Others scavenge dead or dying plants, so they can recycle nutrients.

**Figure 3.13. Life cycle of caterpillars**



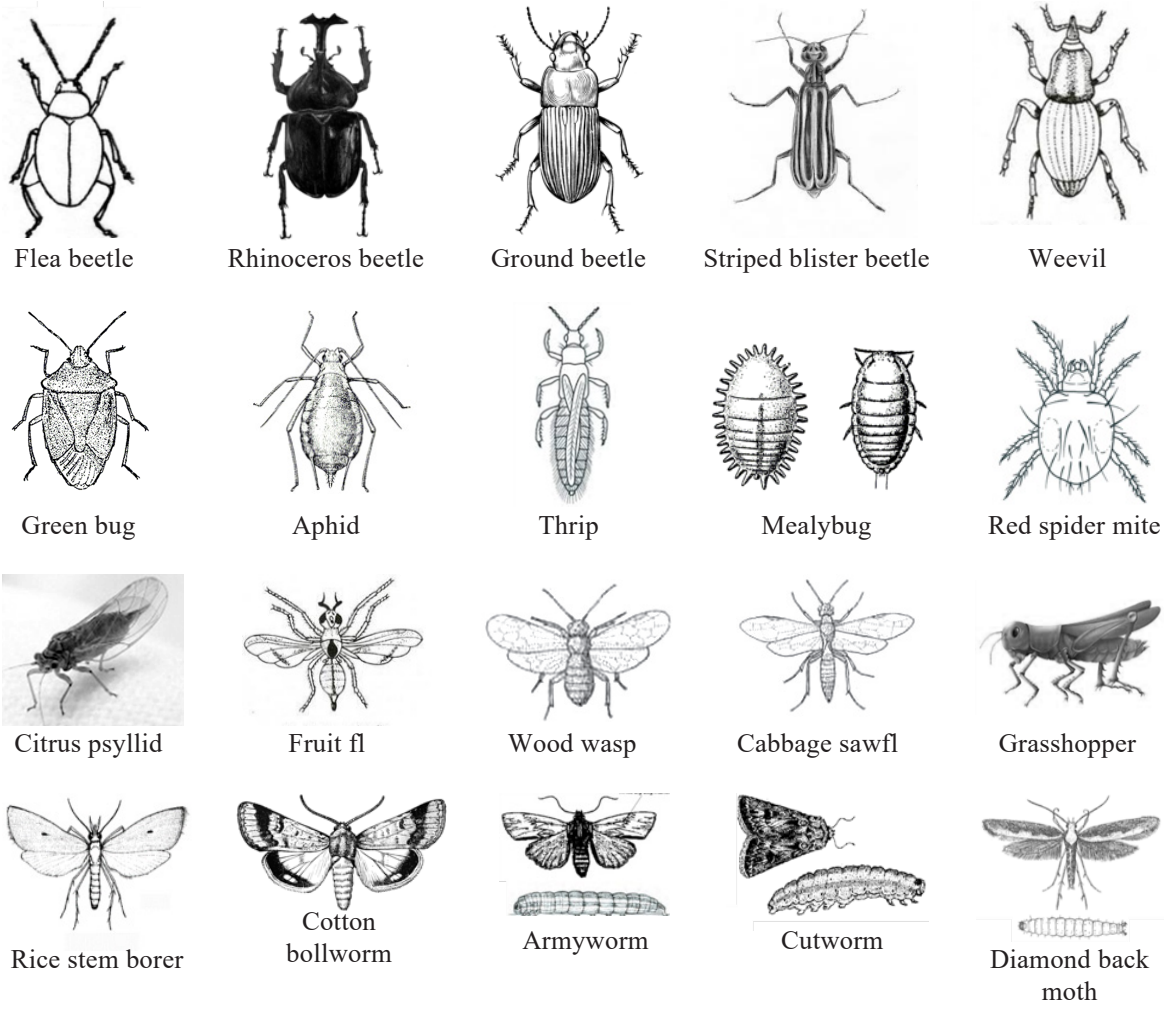
## How do insect pests cause damage?

There are generally two types of crop damage caused by insect pests that are related to their mode of feeding.

**Pests with biting and chewing mouthparts:** These are the more generalised insects. They feed by biting pieces of plant material and chewing, for example, grasshopper, crickets, caterpillars, sawfly, beetles

**Pests with piercing and sucking mouthparts:** These pests have part, or all of the mouthparts modified into a piercing stylet. Sap is sucked either from the phloem (or xylem) system, or from general tissues of foliage, roots or fruits, for example, thrips, aphids, mealybugs.

**Figure 3.14. Some common insect pests infested in agricultural crops**



### Beneficial insects for agriculture

Not all insects are pests which destroy plants. There are a number of beneficial insects that can help eliminate and control pests.

### List of some beneficial insects for agriculture

### Table 3.7. Insects beneficial for agriculture

| Insect | Preys on |
|---|---|
| Ladybug beetle | Aphids, whiteflies, mites, fleas, Colorado potato beetl |
| Ground beetle | Slugs, caterpillars, Colorado potato beetles, cutworms |
| Minute pirate bug | Spider mites, aphids, thrips, caterpillars |
| Green lacewing | Aphids, whiteflies, leafhoppers, mealy bug |
| Aphid midge | Aphids |
| Damsel bug | Caterpillars, mites, aphids, cabbage worms |
| Braconid wasp | Caterpillars, aphids |
| Praying mantis | Wide range including caterpillars, moths, beetles, crickets |
| Spider | Wide range including bed bugs, aphids, grasshoppers, fruit flie |
| Predatory mite | Spider mites |

### Plant parts damaged by insect pests

Insect-pest damage can be grouped according to the part of the plant body attacked. There are six categories:

- Sown seeds and seedlings;
- Fruits and seeds;
- Flowers and buds;
- Leaves;
- Stems; and
- Roots and tubers.

## Methods of pest control

Pests cause a significant reduction in the yield and quality of crops. In general, the measures of pest control consist of two types; preventive and protective. Preventive measures are used before the attack of the pest and protective measures are used to control the pest after their attack. The methods of controlling pests are as follows:

### Mechanical methods

- Picking of pests, larvae by hand and destroying them
- Removing the part or whole plant that is infested
- Use of traps
- Catching them with the help of a net

### Cultural methods

- Crop rotation
- Deep ploughing
- Clean cultivation
- Proper use of fertilisers and water
- Growing pest-resistant varieties
- Timely or late sowing
- Proper harvesting

### Chemical methods

This method is used on a large scale for the direct control of pests. In these methods, chemicals are used to kill pests. These chemicals are called pesticides/insecticides. The chemical method is effective and faster in comparison to other methods, but they are hazardous to the environment. Improper use of these chemicals leads to the development of resistance among the pests causing a heavy outbreak which leads to an increase in the cost of cultivation and heavy loss. Insecticides can be formulated as dust, wettable powders, seed dressers, emulsions, and granules.

## Biological methods

Using biological agents to control pests is called bio-control. Ninety eight percent pests are controlled by nature. There are certain predators, parasites, birds, animals and micro-organisms that can be used for the control of pests, for example, Bacillus thuringenesis.

### Learning activity 1

Select one of the insects listed above and carry out some research into that insect either by reading through the information contained in this textbook, or on the internet. Try to create a fact sheet on that insect that you could use to advise a farmer on how to deal with the insect. Share and compare your factsheets with your peers.

### Review questions

1. There are a number of insects that can be beneficial for plants. List some of these insects and explain how they can be beneficial
2. Why is the control of insect pests important?
3. What are the dangers involved in using chemical methods of pest control?

# Unit Summary

**Key messages**

- Plants are classified into herbaceous plants and woody plants based on the length of the life of the entire plant. They are also classified as annuals, biennials and perennials depending on their seasonal growth.

- A seed is a unique element of life that consists of an embryo with nourishing and protective tissue. Seeds are an excellent nutritional source of protein, vitamins, minerals, fibre, fats and calories for humans. Agriculturally, a seed is a propagating material used for sowing or planting. A seed with one cotyledon is monocotyledonous and a seed with two cotyledons is dicotyledonous. There are two types of germination: epigeal germination and hypogeal germination.

- Plant propagation means increasing the number of plants or multiplying the plants. Two types of propagation are sexual/seed propagation and asexual/vegetative propagation. Natural means of asexual propagation include runners, stolons, suckers, bulbs, corms, rhizome, offshoot, tubers, crown and pseudobulbs. Artificial means of asexual propagation are propagation by cutting, layering, budding, grafting, and tissue culture.

- Cutting is one of the asexual propagation techniques in which a portion of a stem, root, or leaf cut from the parent plant is placed under favourable environmental conditions and induced to form roots and shoots, thus producing a new independent plant.

- Air-layering is a method of plant propagation in which roots are induced to form the aerial part of a plant by making an injury to the branch and then enclosing the wound with a moist rooting medium.

- Soils are complex mixtures of minerals, water, air, organic matter, and countless organisms that are formed from the decaying remains of once living things. Topsoil, being near the surface, is the major zone of root development. Most soils have different sizes of mineral particles. These particles are named sand, silt, or clay, based on their size.

- Sixteen elements (N, P, K, Ca, Mg, S, B, Cl, Cu, Fe, Mn, Mb, Zn, H, O, and C) are required for normal plant growth.

- Fertilisers are the common names of substances or compounds containing one or more essential mineral nutrients that are applied to the soil and sprayed on the leaves for the purpose of providing nutrients to the plant. Fertilisers can be mainly categorised into two groups: Inorganic fertilisers and organic fertilisers. There are three methods of fertiliser application: broadcasting, placement and foliar application.

- An insect is a small arthropod that has six legs, a segmented body divided into three regions (head, thorax, and abdomen), one pair of antennae, and usually wings. There are generally two types of crop damage caused by insect pests related to their mode of feeding: pests with biting and chewing mouthparts and pests with piercing and sucking mouthparts.

- Methods of controlling insect pests are cultural method, mechanical method, chemical method and biological method.

- Plant diseases are covered in the optional lesson, but are included here for completion. Plant diseases can be defined as conditions of the plant involving abnormalities of growth or structure. Most plant diseases are caused by fungus, bacteria, virus and nematodes.

- Methods of controlling diseases are the cultural method, chemical method and physical method.

## Unit reflection

This unit has introduced you to the basic concepts around agriculture, including the different classifications of plants, and the different ways that plants can be propagated either naturally or artificially

You have had the opportunity to practise germinating different seeds, and you have learned about the different types of soil and fertilisers used in the growth of those seeds.

Why is the consistency and make of soil so important?

You have had the opportunity to learn first-hand about insects that affect plants, and you will have discovered the different methods for dealing with those insects.

Are there any beneficial insects? Why are they beneficial to plant

This Agriculture unit has covered all the components from seed germination up to the propagation of fully-grown plants, you have learned about what is needed to be considered to keep a plant healthy, and what problems a plant has to contend with. In the next unit, you will begin to grow your own plants, so try to remember your learning from this unit.

## Further reading

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Tutor, M. (2017). Introduction to Insect Pests and Diseases 1 [Year-3]. Retrieved from https://www.youtube.com/watch?v=LMdn89t4auE

# Glossary

| Terms | Elaborations |
|---|---|
| **Air-layering** | A method of plant propagation in which roots are induced to form the aerial part of a plant by making an injury to the branch and then enclosing the wound with a moist rooting medium. |
| **Annuals** | Plants that complete their life cycle, seed – plant – seed during a single season. They are normally herbaceous. Examples: corn, rice, wheat, and pulses. |
| **Biennials** | Plants that require two years to complete their life cycle. They are normally herbaceous. Examples: carrot, cabbage, cauliflower and onions |
| **Code switching** | Alternating between two or more languages in conversation.[34] |
| **Collaboration** | Working together to produce a better result. |
| **Curriculum** | The content that students must learn in school, typically provided in the form of textbooks. |
| **Cutting** | One of the asexual propagation techniques in which a portion of a stem, root, or leaf cut from the parent plant is placed under favourable environmental conditions and induced to form roots and shoots, thus producing a new independent plant. |
| **Empathy** | To understand or care about the feelings of others. |
| **Fertilisers** | The common names of substances or compounds containing one or more essential mineral nutrients that are applied to the soil and sprayed on the leaves for the purpose of providing nutrients to the plant. Fertilisers can be mainly categorised into two groups: Inorganic fertilisers and organic fertilisers. There are three methods of fertiliser application: broadcasting, placement and foliar application. |
| **Germination** | The process of seeds developing into new plants. |

[34] Oxford Dictionary

| Terms | Elaborations |
|---|---|
| **Herbaceous plants** | Plants in which the aerial portion is relatively short-lived and the tissues comparatively soft. |
| **Hidden Curriculum** | The unwritten learning that students can attain while at school in addition to the official curriculum of learning |
| **Insect** | A small arthropod that has six legs, a segmented body divided into three regions (head, thorax, and abdomen), one pair of antennae, and usually wings. |
| **Local Curriculum** | A curriculum that is determined at the local community or school level instead of the national level. |
| **Medium of instruction** | The language used to teach a subject, different from language as a subject itself. |
| **Methods of controlling insect pests** | Cultural, mechanical, chemical method and biological methods are used to control insect pests from damaging plants. |
| **Methods of controlling diseases** | Cultural, chemical and physical methods are used to control diseases from damaging plants. |
| **Monolingual education** | When a single language of instruction is used at school to the detriment of students that do not speak that language. |
| **Mother tongue** | The language a child first learns and speaks at home |
| **MTB MLE** | An education programme for children who do not understand or speak the official school language when they begin school. MTB MLE students learn to read and write first in their mother tongue. They use their mother tongue for learning as they learn to understand, speak, read and write the official school language (and additional languages according to the curriculum).[35] |
| **Perennials** | Plants that are long-lived, more than two years and are usually woody or herbaceous. Examples: rose, lilies, mango, apple, coconut. |

[35] Malone, S. (2016). *MTB MLE RESOURCE KIT Including the Excluded: Promoting Multilingual Education*. Bangkok: UNESCO.

| Terms | Elaborations |
|---|---|
| **pH** | A measurement of the acidity or alkalinity, on the pH scale, 7.0 is neutral. Below 7.0 is acidic and above 7.0 is basic or alkaline. |
| **Plant** | Classified into herbaceous plants and woody plants based on the length of the life of the entire plant. They are also classified as annuals, biennials and perennials depending on their seasonal growth. |
| **Plant diseases** | Conditions of the plant involving abnormalities of growth or structure. Most plant diseases are caused by fungus, bacteria, virus and nematodes. |
| **Plant propagation** | Increasing the number of plants or multiplying the plants. Two types of propagation are sexual/seed propagation and asexual/vegetative propagation. |
| **Seed** | A unique element of life that consists of an embryo with nourishing and protective tissue, a seed is a propagating material used for sowing or planting. |
| **Sixteen elements** | N, P, K, Ca, Mg, S, B, Cl, Cu, Fe, Mn, Mb, Zn, H, O, and C are required for normal plant growth. |
| **Soils** | Complex mixtures of minerals, water, air, organic matter, and countless organisms that are formed from the decaying remains of once living things. Topsoil, being near the surface, is the major zone of root development. Most soils have different sizes of mineral particles. These particles are named sand, silt, or clay, based on their size. |
| **Translanguaging** | Employing linguistic resources from two or more languages to their greatest effect (code switching can be used).[36] |
| **Woody plants** | Trees and shrubs that have shoots that live for many years. |

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# Annexes

# Annex 1: What nutrients (elements) are required for the growth of plants?

Sixteen elements are necessary for normal plant growth.

### Chemical elements necessary for normal plant growth

| No. | Element (Nutrient) | Chemical Symbol | Major Functions in Plants |
|---|---|---|---|
| 1. | Nitrogen | N | It is for strong, vigorous growth, good leaf colour, and photosynthesis. |
| 2. | Phosphorus | P | It promotes root development, flower blooming, ripening of seed and fruits. |
| 3. | Potassium | K | It improves the overall health of plants. It helps them withstand very hot or cold weather, defend themselves against diseases, helps fruit formation, photosynthesis, and the intake of other nutrients. |
| 4. | Calcium | Ca | It promotes plant vigour, good growth of young roots and shoots, and helps to build cell walls. |
| 5. | Magnesium | Mg | It helps regulate uptake of other plant foods and aids in seed formation. |
| 6. | Sulphur | S | It helps maintain a dark green colour while encouraging more vigorous plant growth. |
| 7. | Boron | B | It helps in cell development and helps to regulate plant metabolism. |
| 8. | Chlorine | Cl | It is involved in photosynthesis. |
| 9. | Copper | Cu | It helps plants to metabolise nitrogen. |
| 10. | Iron | Fe | It assists in the manufacture of chlorophyll and other biochemical processes. |
| 11. | Manganese | Mn | It is needed for chlorophyll production. |
| 12. | Molybdenum | Mo | It helps plants to use nitrogen. |
| 13. | Zinc | Zn | It is used in the development of enzymes and hormones. |
| 14. | Hydrogen | H | It is important for the photosynthetic process. |
| 15. | Oxygen | O | It is important for photosynthesis and respiration. |
| 16. | Carbon | C | It is important for photosynthetic process. |

# Annex 2: Alternative lesson on diseases and methods of control

**Expected learning outcomes**

**By the end of the lesson, you will be able to:**

- Identify plant diseases and methods of control.

**What are plant diseases?**

Plant diseases can be defined as conditions of the plant involving abnormalities of growth or structure.

**Causes of plant diseases**

These are many factors which cause plants to appear unhealthy. The most important effect of disease for the farmers is the reduction in crop yield or quality which results. Most plant diseases are caused by the three main pathogenic microbes and nematodes:

- Fungus;
- Bacteria;
- Virus; and
- Nematodes (certain nematodes also cause plant disease).

**The disease triangle**

Plant diseases can be analysed conveniently using the concept called the ‘disease triangle’; this places the three factors which must interact to cause plant disease at the three corners of a triangle. Those three factors are:

- Susceptible host (plant);
- Pathogen (disease causing organism); and
- Favourable environment for disease.

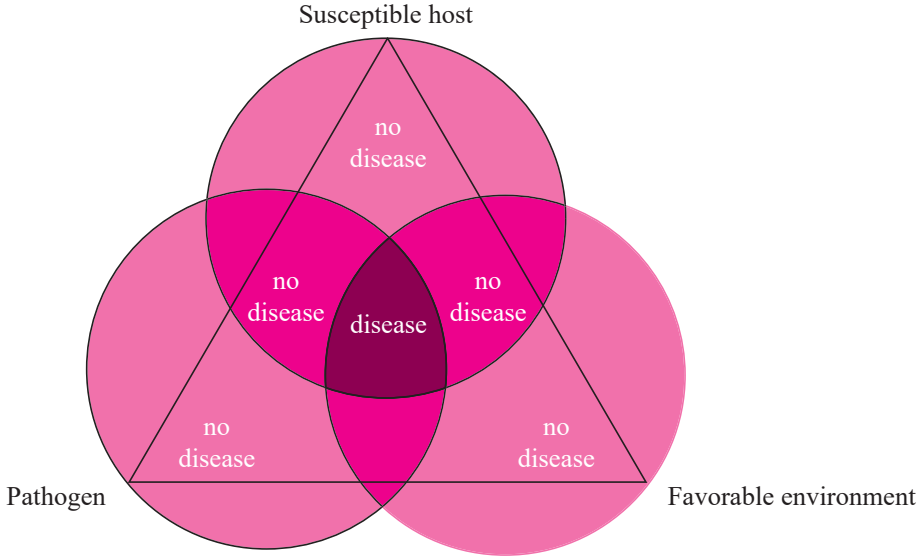
The **host** is the plant itself; some can fall victim to many diseases, others only suffer particular ones. So, all plants have a range of susceptibilities to a range of diseases.

The **pathogen** is the disease. Diseases of plants are most often caused by fungi but there are some plant pathogenic bacteria and viruses. Without the right host in the right conditions, pathogens cannot cause any harm. Some pathogens are specific to only one or a few host plants; others have broad abilities to attack almost everything.

The **favourable environment** essentially means the weather conditions needed for a pathogen to thrive (this is an important point; it's 'a favourable environment for disease' and if the pathogen is present and results in disease, it is obviously an **unfavourable** environment for the plant).

Disease occurs only if all three things occur simultaneously; if one or more of the factors is not present, then disease does not occur.

**Disease triangle**



## Disease symptoms

A **symptom** of plant disease is a visible effect of disease on the plant. Symptoms may include a detectable change in colour, shape or function of the plant as it responds to the pathogen. Here are a few examples of common symptoms of fungal, bacterial, viral and nematode plant diseases.

## Fungal disease symptoms

- Birds-eye spot on berries (anthracnose)
- Damping-off of seedlings (phytophthora)

**Fungal disease symptoms. Left: Birds-eye Spot on Berries; Right: Damping-off on tomato seedling**

*Source*: Birds-eye spot on berries
https://ag.purdue.edu/btny/ppdl/Pages/POTW_old/8-16-10.html

*Source:* Damping-off of tomato seedling
http://www.tomatodirt.com/damping-off.html

## Bacterial disease symptoms

- Canker
- Crown gall

## Bacterial disease symptoms. Left: Canker on citrus; Right: Crown gall

*Source:* Canker on citrus
http://istudy.pk/citrus-canker/

*Source:* Crown gall
https://www.rhs.org.uk/advice/profile?PID=14

## Viral disease symptoms

- Crinkled leaves (leaf curl)
- Fruit malformation

## Viral disease symptoms. Left: Leaf curl in chilli; Right: Fruit malformation

*Source:* Leaf curl in chilli
http://agropedia.iitk.ac.in/content/chilli-leaf-curl

*Source:* Fruit malformation
https://www.apsnet.org/edcenter/intropp/PathogenGroups/Pages/PlantViruses.aspx

**Disease symptoms caused by nematodes**

- Root cysts
- Root knot

**Disease symptoms caused by nematodes. Left: Root cyst in tobacco; Right: Root knot**

*Source:* Root cyst in tobacco
http://ctrf1.com/2018/01/tobacco-cyst-nematode-found-in-ontario-tobacco-field /

*Source:* Root knot
https://aggie-horticulture.tamu.edu/galveston/weekly_Q&A/h&v_6.htm\

**Methods of disease control**

**General strategies**

- Exclude the pathogen: prevent inoculum from coming into an area where the pathogen does not occur (e.g. quarantines, inspections, certifications).
- Eradicate the pathogen: remove or reduce inoculum (e.g. rotation, sanitation, eliminating alternate hosts, heat treatment, some pesticides).
- Protect the healthy plant against infection: provide a "barrier" (chemical, biological, or physical) between the host plant and the pathogen.
- Genetic resistance of the plant against the pathogen: grow a less susceptible host plant.
- Avoidance: avoid development of a disease on a plant(s) even though it does occur in the area.

## Cultural control

- Sanitation: clean environment; remove or reduce sources of inoculum (weed and alternative hosts, insect vectors, debris).
- Pruning: remove infected tissue, promote more vigorous growth, and increase air circulation.
- Watering: avoid overwatering or under-watering and flooding soils.
- Planting date: unfavourable conditions for pathogen, favourable for host.
- Fertility: avoid over-fertilisation or under-fertilisation.
- Rotation: non-host plants and resistant varieties, reduce soil-borne pathogen populations.
- Trap plants and antagonistic plants, e.g. marigolds.
- Quarantines, restrictions on moving plant materials across county, state, or national borders.

## Chemical control

- Chemical barrier to protect the host plant and/or eradicate an existing infection. Pesticides typically cannot “cure” heavily diseased plants.
- Types of pesticides: fungicides, bactericides, nematicides, insecticides.

## Physical control

- Heat treatment - steam sterilisation of soil/materials; soil solarisation, heat treatments.
- Cold treatment - refrigeration (postharvest).
- Moisture management - reducing humidity; drying out of bulbs, tubers, etc. for winter storage.

### Learning activity 1

Investigate some of the plants that you have studied in this subject so far this year and discover what diseases they are susceptible to, consider the disease triangle for your chosen plant and try to complete the three variables. Share your findings with your peers and compare plants.

### Review questions

1. What is meant by a ‘favourable environment’ for disease?
2. What are some of the symptoms of plant disease that are common in Myanmar?
3. What methods of disease control are considered cultural control?

# Notes

# Notes

The Government of the Republic of the Union of Myanmar
Ministry of Education