

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

I. A. SHUMSKA, L. M. POPOVA, V. A. ZOTIA

# ***ENGLISH FOR AGRONOMISTS***

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development and legal support» country (ORACS) and Ukraine  
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The Teaching Manual is based on authentic English texts and professionally-oriented for agronomic specialties, contains a complex of lexical and communicative exercises, a block of grammar tests and supplemented by English-Ukrainian and Ukrainian-English dictionaries of professional vocabulary.

It is offered for studying of English by students of agrarian educational institutions of III - IV levels of accreditation in the specialties «Agronomy», «Horticulture and viticulture», «Plant protection and quarantine» and «Landscape gardening». The teaching manual will be useful for researchers, teachers, graduate students, doctoral students and specialists of agricultural enterprises.

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МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ

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# ***ENGLISH FOR AGRONOMISTS***

*Розроблено в рамках співпраці Одеської обласної  
сільськогосподарської дорадчої служби «Центр розвитку та  
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Навчальний посібник укладений на основі автентичних англomовних текстів та професійно-орієнтований для агрономічних спеціальностей, містить комплекс лексико-комунікативних вправ, блок граматичних тестів та доповнений англо-українським та українсько-англійським словниками з професійної лексики.

Пропонується для вивчення англійської мови студентами аграрних навчальних закладів III – IV рівнів акредитації зі спеціальностей «Агрономія», «Садівництво та виноградарство», «Захист і карантин рослин» та «Садово-паркове господарство». Навчальний посібник буде корисним для наукових працівників, викладачів, аспірантів, докторантів та спеціалістів сільськогосподарських підприємств.

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## PREFACE

Радикальні зміни, що здійснюються в національній системі вищої освіти в Україні, які було започатковано процесом інтеграції країни в європейський освітній простір, стали важливою передумовою створення даного видання. Навчальний посібник «English for Agronomists» створений з метою формування у студентів агрономічних спеціальностей навичок та вмінь опрацювання оригінальних текстів фахової тематики англійською мовою, засвоєння нового лексичного та граматичного матеріалу, розвитку практичних навичок використання фахової англомовної термінології в учбовій, науковій та виробничій діяльності.

Даний посібник укладений на основі автентичних англомовних текстів з ретельно підібраним профільованим термінологічним та граматичним матеріалом. Усі теми у навчальному посібнику мають єдину структуру, що сприяє кращій орієнтації у навчальному матеріалі та успішному його засвоєнню. Запропоновані авторами різностильові тексти сприятимуть використанню в навчальному процесі різних видів читання.

Основна частина посібника складається з чотирьох розділів, містить блок граматичних тестів та доповнена англо - українським та українсько - англійським словниками з професійної лексики, які спрямовані на розширення словникового запасу майбутніх фахівців. Кожний розділ містить тексти професійно-орієнтованого для агрономічних спеціальностей спрямування та словник активної лексики, що допоможе подолати труднощі при перекладі.

Відбір теоретичного матеріалу посібника проводився з урахуванням критерію тематичності, чого було досягнуто завдяки співпраці авторів з профільними кафедрами. При опрацюванні запропонованих тем студенти залучатимуть свої знання, які вони отримали з курсу профільних дисциплін, що сприятиме більшій мотивації, яка є рушійною силою у процесі вивчення мови.

З метою успішної реалізації навчання читання, окрім відбору професійно-орієнтованих текстів, особливу увагу авторами було приділено складанню комплексу лексико - комунікативних вправ спрямованих на закріплення мовних елементів фахового стилю.

Навчальний посібник «English for Agronomists» пропонується для вивчення англійської мови студентами аграрних навчальних закладів III – IV рівнів акредитації зі спеціальностей «Агрономія», «Садівництво та виноградарство», «Захист і карантин рослин» та «Садово-паркове господарство».

# **PART I**

## **AGRICULTURE IN UKRAINE**

### **Text I**

#### **Introduction**

#### **I. Read and translate the text.**

Geographically Ukraine consists of Western Ukraine, North-Western Ukraine, Eastern Ukraine, South Ukraine and Central Ukraine. It is the second largest country in Europe. Plains cover the most territory of Ukraine. Mixed forests and steppes prevail on the plains of Ukraine. About half of the country area is used for plant growing, forests occupy 18% of the territory.

Did you know? Ukraine, commonly known as the breadbasket of Europe, has over a quarter of the world's chernozem or "black earth" and 54 percent of its land is arable according to the Food and Agriculture Organization of the United Nations [5].

Agriculture in Ukraine is one of the most important branches of its economy due to variety of climatic and demographic reasons. The agriculturally used areas take 69,1% of Ukrainian territory. More than half of all planted areas consists of cereal crops – wheat, corn (maize), rice, rye, oat, barley, millet, buckwheat. Furthermore, the main specialization field of Ukrainian agriculture is plant production, particular production of industrial and feed crops: sugar beets and sunflowers. Ukraine is the biggest region of essential oil plants production: roses, lavenders, sages. Ukraine is the leader of sunflower oil production: 4.2 million tons per year – this is 28% of the world's production.

Ukraine grows 7 times more grain than coffee around the world. But agriculture includes not only grain, milk and meat. Ukraine is one of the world leaders in the field of nuts cultivation. In 2015 marketing year, Ukraine has grown 96.9. tons of walnuts, it is the 6th place in the world.

Rape is one more reason for pride. In the 2014/2015 marketing year, world exports of rape amounted to 14.2 million tons. Ukraine took the third place in this area (14%).

It is necessary to notice, that nowadays European Union becomes the main export market for Ukrainian agricultural products. All these facts confirm, that agricultural industry of Ukraine is one of the most attractive branches for investments [6].

## II. Learn the following verbs.

|               |                              |
|---------------|------------------------------|
| to consist of | складатися з                 |
| to cover      | покривати                    |
| to grow       | рости, вирощувати            |
| to amount     | складати, становити          |
| to confirm    | підтверджувати, стверджувати |
| to prevail    | переважати                   |
| to include    | включати                     |
| to notice     | зазначати                    |

## III. Match the following words.

|               |                          |
|---------------|--------------------------|
| a) wheat      | 1) овес                  |
| b) rye        | 2) соняшник              |
| c) oat        | 3) рапс                  |
| d) barley     | 4) гречка                |
| e) millet     | 5) цукровий буряк        |
| f) buckwheat  | 6) ячмінь                |
| g) sugar beet | 7) шавлія                |
| h) sunflower  | 8) зернові, хлібний злак |
| i) cereal     | 9) горіх                 |
| j) sage       | 10) пшениця              |
| k) nut        | 11) жито                 |
| l) rape       | 12) просо                |

## IV. Show general understanding of the text answering the questions.

1. What is one of the most important branches of economy in Ukraine?
2. What favours to the agricultural development in Ukraine?
3. What crops occupy half of planted area of Ukrainian territory?
4. What parts does Ukraine consist of?
5. What is the main export market for Ukrainian agricultural products?

## V. Fill in the blanks with the correct words and phrases from the word bank.

**Word bank – plant, investments, steppes, leaders, plains.**

1. .... cover the most territory of Ukraine.
2. Mixed forests and .... prevail on the plains of Ukraine.
3. The main specialization field of Ukrainian agriculture is .... production.
4. Ukraine is one of the world .... in the field of nuts cultivation.
5. Agricultural industry of Ukraine is one of the most attractive branches for .....

## **VI. Match the words (1- 3) with the definitions (A-C).**

- 1 - cereal
- 2 - feed
- 3 - market

- A) .... is a food given to animals.
- B) A .... is a place or area where products are advertised and sold.
- C) A .... plant is one that makes grain.

## **Text 2**

### **Agriculture in different parts of Ukraine**

#### **I. Read and translate the text.**

Western Ukraine is rich in diverse agricultural and natural resources. Cattle breeding, pig breeding, grain planting, flax and sugar beet cultivation are widespread. Due to the geological and climate conditions these lands can't be used for arable planting. Therefore, sheep breeding traditionally played the leading role here. The steep mountain slopes are suitable for agricultural sector. "Polonyny" or subalpine grasslands are covered with plants which sheep can eat. Flax and potato are also popular here.

In the North-Western area people mostly cultivate rye, flax, hop, wheat, sugar beet and potato. However, the region tends to live off cattle breeding: pig and sheep breeding, poultry, rabbit and fish farming, as well as beekeeping are popular.

In Central Ukraine people cultivate winter wheat, barley, maize, sugar beet, sunflower, hemp, coriander. The leading sectors are milk production and cattle breeding. Enterprises specializing in breeding pigs, sheep, rabbit and poultry are also popular.

South Ukraine is the region of immense steppes, fertile soil and intensive sun shining regime. At the same time some of these areas suffer from the lack of the water resources in summer. Large areas are used for vineyards, orchards, cultivating vegetables, melon and watermelon. Dairy and beef cattle, pigs, poultry and sheep breeding is widespread. Fish breeding is developed in the regions washed by the Black and Azov seas.

The main specialization of agricultural production in Eastern Ukraine is the cultivation of cereals, sugar beet and sunflower. Potatoes and vegetables are grown in suburban areas of the large cities. In sector of animal husbandry dairy and meat cattle breeding dominates [6].

## II. Learn the following words and word - combinations.

|                      |                    |
|----------------------|--------------------|
| diverse              | різноманітний      |
| variety              | сорт, різновид     |
| cattle breeding      | скотарство         |
| arable               | орний              |
| subalpine grasslands | субальпійські луки |
| fertile soil         | родючий ґрунт      |
| poultry              | домашня птиця      |
| mountain slopes      | гірські схили      |
| beekeeping           | бджільництво       |
| lack of water        | нестача води       |
| dairy                | молочний           |

## III. Match the following words.

|                |             |
|----------------|-------------|
| a) flax        | 1) конопля  |
| b) hop         | 2) кавун    |
| c) hemp        | 3) картопля |
| d) coriander   | 4) льон     |
| e) melon       | 5) хміль    |
| f) water melon | 6) коріандр |
| g) potato      | 7) диня     |

## IV. Show general understanding of the text answering the questions.

1. What types of animal husbandry are widespread in Western Ukraine?
2. Are lands arable in Western Ukraine? Why not?
3. What crops are cultivated in the North - Western area?
4. What is the leading sector of agriculture in Central Ukraine?
5. What crops do farmers grow in Eastern Ukraine?

## V. Fill in the blanks with the correct words and phrases from the word bank.

**Word bank – sun shining, dairy, fish, arable, breeding.**

1. Lands in Western Ukraine can't be used for .... planting due to the geological and climate conditions.
2. In Central Ukraine enterprises specializing in .... pigs, sheep, rabbit and poultry are popular.
3. South Ukraine is the region of fertile soil and intensive .... regime.
4. .... breeding is developed in the regions washed by the Black and Azov seas.
5. In Eastern Ukraine .... and meat cattle breeding dominate.

## **VI. Match the words (1- 6) with the definitions (A-F).**

- 1 - cattle
- 2 - poultry
- 3 - winter wheat
- 4 - hemp
- 5 - melon
- 6 - beef

- A) ... is a type of wheat that farmers plant in fall and harvest in spring or summer.
- B) .... is a type of plant that produces tough fibers.
- C) A .... is a large, sweet part of fruit.
- D) .... is the name for the meat derived from cattle.
- E) .... are the cows and bulls raised on a farm or ranch for beef or milk.
- F) .... are birds raised on farm for eggs and for meat.

## **Text 3**

### **Soil**

#### **I. Read and translate the text.**

Soil is a critical part of successful agriculture. Soil provides the structural support and the source of water and nutrients for plants.

For the formation of soil, it takes around hundreds to thousands of years. Soil is the part of the earth's surface which includes disintegrated rock, humus, inorganic and other organic materials that provides the medium for plants growth.

Inorganic material is the major component of most soils. It consists largely of mineral particles with specific physical and chemical properties which vary depending on the parent material and conditions under which the soil was formed. Processes such as leaching and weathering combine to make a whole range of different soil types, each of which has particular strengths and weaknesses for agricultural production. It is the inorganic fraction of soils which determines soil physical properties such as texture and has a large effect on structure, density and water retention [69].

Soil texture and soil structure are both unique properties of the soil that will have a profound effect on the behavior of soils, such as water holding capacity, nutrient retention and supply, drainage, and nutrient leaching [57].

The texture of soil is a property which is determined largely by the relative proportions of inorganic particles of different sizes. Sand, silt, clay, and organic matter particles in a soil combine with one another to form larger

particles. Soil structure is the arrangement of the soil particles into aggregates of various sizes and shapes [58].

Soil organic matter (SOM) is the organic matter component of soil, consisting of plant and animal detritus at various stages of decomposition, cells and tissues of soil microbes, and substances that soil microbes synthesize. SOM provides numerous benefits to the physical and chemical properties of soil and its capacity to provide regulatory ecosystem services. SOM is especially critical for soil functions and quality [56].

## II. Match the following words and word - combinations.

|                        |                        |
|------------------------|------------------------|
| a) land surface        | 1) хімічні властивості |
| b) support             | 2) збереження вологи   |
| c) nutrients           | 3) підтримувати        |
| d) chemical properties | 4) розпадатися         |
| e) parent material     | 5) поверхня землі      |
| f) disintegrate        | 6) поживні речовини    |
| g) mineral particles   | 7) неорганічна частка  |
| h) inorganic fraction  | 8) мінеральні частинки |
| i) water retention     | 9) материнська порода  |

## III. Show general understanding of the text answering the questions.

1. What does the soil provide?
2. What does the soil include as the part of the earth's surface?
3. What is the major component of most soils?
4. What do chemical and physical properties of soil depend on?
5. What processes promote making different types of soil?
6. What do soil texture and soil structure have effect on?
7. What is the texture of soil?
8. What is the structure of soil?
9. What are the advantages of SOM?

## IV. Agree or disagree with the following statements.

1. Soil provides the source of water and nutrients for plants.
2. Soil doesn't play an important role for successful agriculture.
3. Formation of soil takes around hundreds to thousands of years.
4. Inorganic material largely consists of mineral particles.
5. Soil structure, density and water retention are not influenced by the inorganic fraction.
6. Soil organic matter (SOM) is the inorganic matter component of soil.

**V. Fill in the blanks with the correct words and phrases from the word bank.**

**Word bank - properties, surface, inorganic fraction, cells and tissues, types, agriculture.**

1. Soil is an important part of successful ....
2. Soil is the part of the earth's .... that provides the medium for plants growth.
3. Different soil .... have particular strengths and weaknesses for agricultural production.
4. The .... has a large effect on structure, density and water retention.
5. Soil texture and soil structure are unique .... of soil.
6. Soil organic matter is the organic matter component of soil consisting of .... of soil microbes.

**VI. Match the words (1- 5) with the definitions (A-E).**

- 1 – soil
  - 2 – plant density
  - 3 – humus
  - 4 – soil structure
  - 5 – soil texture
- A) ... is the number of plants in a certain area.
  - B) ... is the classification of the size of particles within soil.
  - C) ... is the layer of the earth's surface in which plants grow.
  - D) ... is how the particles in soil are connected to each other and how much space is between them.
  - E) ... is a type of soil made of dead plants or other organic matter.

## **Text 4**

### **Types of soil in agriculture**

**I. Read and translate the text.**

There are various types of soil that undergo diverse environmental pressures. The soil is mainly classified by its texture, proportions and different forms of organic and mineral compositions.

The soil type helps farmers decide what crops will grow best because some crops do better with particular types of soil. From northwest to southeast the soils of Ukraine may be divided into three major aggregations: a zone of sandy podzolized soils; gray forest soils, a central belt consisting of the black, extremely fertile Ukrainian chernozems and a zone of chestnut soils [5].

The podzolized soils occupy about one-fifth of the country's area, mostly in the north and northwest. Most such soils may be farmed, although they require the addition of nutrients to obtain good harvests. The podzolized soils contain a low percentage of humus (up to 1.5%). They are not fertile.

Chernozem is a very fertile soil that produces high agricultural yields and offers excellent agronomic conditions for the production of crops, especially cereals and oilseeds. It is rich in phosphoric acids, phosphorus and ammonia. Chernozem also contains a high percentage of humus (up to 15% compared to 4% in average soils), which is an organic substance that consists of decayed plant or animal matter. As it decomposes, the color of the soil becomes darker and increases soil aggregation and the ability to attract and retain nutrients [5].

The chernozems of central Ukraine, among the most fertile soils in the world, occupy about two-thirds of the country's area. These soils may be divided into three broad groups: in the north a belt of the so-called deep chernozems, about 5 feet (1.5 metres) thick and rich in humus; south and east is a zone of prairie, or a zone of ordinary chernozems, which are equally rich in humus but only about 3 feet (1 metre) thick; and the southernmost belt, which is even thinner and has still less humus [67].

In the dry steppe areas in low moisture and poor vegetation appeared chestnut soils. They have little humus content 0,7-2,9 %, but powerful enough humus – 55 cm for obtaining high yields of crops, these soils require additional moisture [38].

Chestnut soils are divided into three subtypes: dark chestnut, chestnut and light chestnut [38]. Dark chestnut soils that developed on loess-like loam are the most common dry-steppe soils of southern Ukraine and Crimea. Chestnut and light chestnut solonetzic soils on heavy loam and clay are typical for the Caspian region [7].

Interspersed in various uplands and along the northern and western perimeters of the deep chernozems are mixtures of gray forest soils and podzolized black-earth soils, which together occupy much of Ukraine's remaining area. All these soils are very fertile when sufficient water is available. However, their intensive cultivation, especially on steep slopes, has led to widespread soil erosion and gullyng [67].

## II. Match the following words and word - combinations.

|                        |                                       |
|------------------------|---------------------------------------|
| a) undergo pressure    | 1) рослини, що перегнули (розклалися) |
| b) mineral composition | 2) зазнавати тиску                    |
| c) podzolized soil     | 3) засолений ґрунт                    |
| e) salinized soil      | 4) органічна речовина                 |
| f) breadbasket         | 5) родючий ґрунт                      |
| g) phosphoric acid     | 6) мінеральний склад                  |
| h) organic substance   | 7) фосфорна кислота                   |
| i) decayed plants      | 8) опідзолений ґрунт                  |
| j) retain nutrients    | 9) достатня кількість води            |
| k) sufficient water    | 10) житниця, головний зерновий район  |
| l) fertile soil        | 11) зберігати поживні речовини        |

## III. Match the following verbs.

|                 |                  |
|-----------------|------------------|
| a) to reduce    | 1) продовжувати  |
| b) to determine | 2) забезпечувати |
| c) to generate  | 3) включати      |
| d) to put back  | 4) зменшувати    |
| e) to provide   | 5) визначати     |
| f) to proceed   | 6) розбивати     |
| g) to include   | 7) створювати    |
| h) to break up  | 8) вносити       |

## IV. Show general understanding of the text answering the questions.

1. How is soil classified?
2. How can testing of soils help farmers in growing crops?
3. What are three major aggregations of soil?
4. Why is Ukraine called the breadbasket of Europe?
5. What crops grow better in chernozem?
6. What groups are the chernozems of central Ukraine divided into? Give short characteristics of each group.

## V. Agree or disagree with the following statements.

1. Soils undergo diverse environmental pressure.
2. Soil is classified by inorganic composition.
3. The podzolized soils occupy one-third of the country's area.
4. Chernozem is a soil that produces high agricultural yields.
5. A percentage of humus in chernozem is not very high.
6. Humus is an organic substance that consists of decayed plants or animal matter.
7. As humus decomposes the ability of soil to retain nutrients decreases.

8. Intensive cultivation of the deep chernozem along the northern and western perimeters has led to soil erosion.

**VI. Fill in the blanks with the correct words and phrases from the word bank.**

**Word bank - acids, nutrients, decomposition, chernozems, conditions, types.**

1. Some crops do better in particular .... of soil.
2. Most podzolized soils require the addition of .... to obtain good harvests.
3. Chernozem offers excellent agronomic .... for the production of crops.
4. Chernozem is rich in phosphoric .....
5. The color of the soil becomes darker after the .... of humus.
6. The .... of central Ukraine occupy about two-thirds of the country's area.

**VII. Match the words (1- 4) with the definitions (A-D).**

- 1 - yield
- 2 - nutrient
- 3 - erosion
- 4 - ammonia

A) A ... is any substance food that helps plants or animals live and grow.

B) ... occurs when wind or water removes the soil from a particular area and leaves it somewhere else.

C) ... is a chemical made from Nitrogen and Hydrogen, created during fixation.

D) ... is the amount or quantity of a crop that is produced.

## **PART II PLANT ORGANS**

### **Text 5 Plant structure**

**I. Read and translate the text.**

Like animals, plants contain cells with organelles in which specific metabolic activities take place. Unlike animals, however, plants use energy from sunlight to form sugars during photosynthesis. In addition, plant cells have cell walls, plastids, and a large central vacuole: structures that are not

found in animal cells. Each of these cellular structures plays a specific role in plant structure and function.

In plants, just as in animals, similar cells working together form a tissue. When different types of tissues work together to perform a unique function,

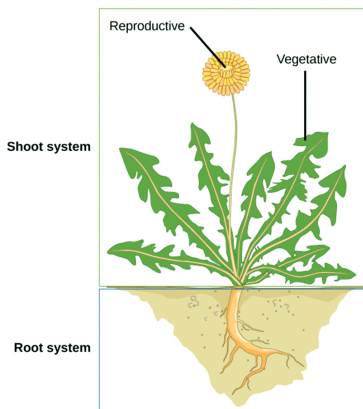


Figure 1. The organ systems of a typical plant [54]

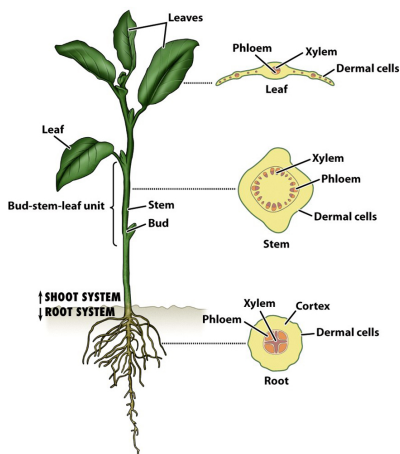


Figure 2. The plant organs and vascular tissues

they form an organ; organs working together form organ systems [54]. Most plants are vascular, which means they have a system of tubules inside them that carry nutrients around the plant. Vascular plants are differentiated from plants such as algae, which do not have a vascular system.

Most vascular plants are seed plants. There are two main types of seed plants: gymnosperms (conifers, which produce pinecones) and angiosperms (flowering plants). Of the 500,000 different species of plants, more than 300,000 are flowering plants [60].

Vascular plants have two distinct organ systems: a shoot system, and a root system (Figure 1). The shoot system consists of two portions: the vegetative (non-reproductive) parts of the plant, such as the leaves and the stems, and the reproductive parts of the plant, which include flowers and fruits (cones or spores, and so on). The shoot system generally grows above ground, where it absorbs the

light needed for photosynthesis. The root system, which supports the plants and absorbs water and minerals, is usually underground.

Each organ (roots, stems, and leaves) include all three tissue types (ground, vascular, and dermal) (Figure 2). Different cell types comprise each

tissue type, and the structure of each cell type influences the function of the tissue it comprises [54].

## II. Learn the following words.

|             |                  |
|-------------|------------------|
| organelles  | органели         |
| plastids    | пластиди         |
| cellular    | клітинний        |
| tissue      | тканина          |
| vascular    | судинний         |
| nutrients   | поживні речовини |
| gymnosperms | голонасінні      |
| angiosperms | покритонасінні   |
| conifers    | хвойні           |

## III. Match the following words and word - combinations.

|                         |                           |
|-------------------------|---------------------------|
| a) central vacuole      | 1) система пагонів        |
| b) vascular plants      | 2) система каналців       |
| c) shoot system         | 3) насінєві рослини       |
| d) metabolic activities | 4) судинні рослини        |
| e) root system          | 5) метаболічна діяльність |
| f) tissue               | 6) коренева система       |
| g) system of tubules    | 7) тканина                |
| h) seed plants          | 8) центральні вакуолі     |

## IV. Show general understanding of the text answering the questions.

1. Where do metabolic activities take place?
2. What is the difference between plant cells and animal cells?
3. How is organ formed?
4. What are two main types of seed plants?
5. What organ systems do vascular plants have?
6. What are the reproductive parts of plants?
7. What are the functions of the root system?

## V. Agree or disagree with the following statements.

1. Photosynthesis is formed only in plants.
2. Cell walls and plastids can also be found in animal cells.
3. Both in plants and in animals, similar cells form a tissue.
4. Organ systems are formed by organs working together.
5. The non-reproductive parts of the plant are the leaves and the stems.
6. The shoot system generally grows underground.

## VI. Fill in the blanks with the correct words and phrases from the word bank.

**Word bank – ground, algae, sugars, tissues, light, plants.**

1. Like animals, .... contain cells with organelles.
2. Plants use energy from sunlight to form.... during photosynthesis.
3. Different types of .... work together to perform a unique function.
4. The shoot system generally grows above ....., where it absorbs the .... needed for photosynthesis.
5. Vascular plants are differentiated from plants such as .....

## Text 6 Roots

### I. Read and translate the text.

The roots of plants have three major functions: anchoring the plant to the soil, absorbing water and minerals and transporting them upwards, and storing the products of photosynthesis. Some roots are modified to absorb moisture and exchange gases. Most roots are underground. Some plants, however, also have adventitious roots, which emerge above the ground from the shoot [53].

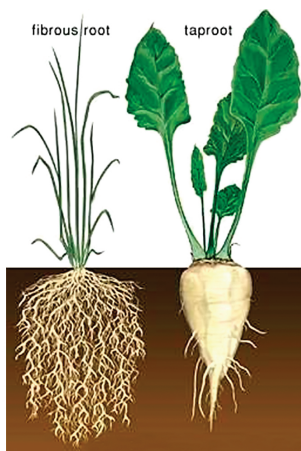


Figure 3. Two types of root system:  
(left) the fibrous roots of grass and  
(right) the fleshy taproot of a sugar beet [21]

All roots have similar functions, however, their structure varies. Hence, based on these criteria, the root system is classified into two types: tap root system and fibrous root system. Dicots have a tap root system, while monocots have a fibrous root system (Figure 3).

A taproot system has a main root that grows down vertically, and from which many smaller lateral roots arise. Taproots penetrate deep into the soil. Mustard, carrot, beetroot, parsley, tomatoes and all dicotyledons are examples of taproot systems. In contrast, a fibrous root system is located closer to the soil surface, and forms a dense network of roots that also helps prevent soil erosion.

Rice, wheat, maize, marigold, onion and all monocotyledons are some examples of the fibrous root system.

Some plants have a combination of tap roots and fibrous roots. Plants that grow in dry areas often have deep root systems, where as plants growing in areas with abundant water are likely to have shallower root systems [53].

Root structures may be modified for specific purposes and their modifications occur: roots, tubers, respiratory roots, support, aerial roots, and so on. For example, the taproots of carrot and turnip get swollen to store food [31].

Aerial roots and prop roots are two forms of aboveground roots that provide additional support to anchor the plant. Different plants have grown them. They can have different functions.

*For support:* Sometimes such roots are grown for support. Ivy plants have them to cling to structures, such as stone walls, or other trees. In maize aboveground prop roots develop from the nodes to provide additional support.

*Roots for breathing:* Some plants grow in environments where there is much water in the soil. They may then grow such roots (upwards) to breathe air. Black mangroves have such roots, for example.

*As a parasite:* Parasites sometimes grow these into the host to get nutrients. One example of this is the mistletoe [2].

*Epiphytic roots* enable a plant to grow on another plant. They are not parasites. Epiphytes use other plants only as support. For example, orchids and banyan tree [53].

*Roots to propagate:* Some plants have aboveground roots. In some places, little plants (with leaves and roots) develop. They will drop off at some point, and develop into new plants (that are clones of the parent). Examples for this are strawberries [2].

## II. Learn the following words and word - combinations.

|                        |                              |
|------------------------|------------------------------|
| absorb moisture        | поглинати вологу             |
| adventitious root      | додатковий корінь            |
| tap root               | головний (стрижневий) корінь |
| fibrous root system    | мичкувата коренева система   |
| lateral root           | боковий корінь               |
| dense network of roots | густа сітка коренів          |
| abundant               | рясний                       |
| aboveground roots      | надземні корені              |
| aerial root            | повітряний корінь            |
| prop root              | ходульний корінь             |
| epiphytic root         | епіфітний корінь             |

### **III. Show general understanding of the text answering the questions.**

1. What are the main functions of the root?
2. What are the types of root system?
3. What root system do plants growing in dry areas have?
4. What root system do plants growing in areas with abundant water have?
5. What is the purpose of the aboveground roots?
6. What roots are modified for food storage?
7. What are the examples of plants with taproots system?
8. What are two forms of aboveground roots?
9. What are the functions of aboveground roots?

### **IV. Agree or disagree with the following statements.**

1. Most roots are underground.
2. Monocots have a tap root system.
3. Small lateral roots arise from a main root.
4. It's a fibrous root system that penetrates deep in the soil.
5. Some plants have a combination of tap roots and fibrous roots.
6. A fibrous root system has a main root that grows down vertically.
7. Black mangroves have aboveground roots.
8. One of the functions of aboveground roots is breathing.

### **V. Fill in the blanks with the correct words and phrases from the word bank.**

**Word bank –network, fibrous, anchor, another, combination, ground, structure, food, tap.**

1. Adventitious roots emerge above the .... from the shoot.
2. A .... root system penetrates deep into the soil.
3. A fibrous root system forms a dense .... of roots.
4. Tap roots are examples of roots that are modified for .... storage.
5. All roots have similar functions, however, their ....varies.
6. Rice, wheat and onion are examples of .... root system.
7. Aboveground roots provide additional support to .... the plant.
8. Epiphytic roots enable a plant to grow on .... plant.
9. Some plants have a .... of tap roots and fibrous roots.

### **VI. Match the words (1- 5) with the definitions (A- E).**

- 1 – root
- 2 – branch
- 3 – moisture

4 – storage

5 – parasite

A) .... is the act of keeping something somewhere while it is not in use.

B) A.... is an organism that lives on or in another organism.

C) .... is the underground part of a plant that draws water and minerals from the surrounding soil.

D) .... refers to the tiny amounts of water in the air or on something.

E) .... is a thick limb from which stems grow.

## Text 7

### Root Growth and Anatomy

#### I. Read and translate the text.

Root growth begins with seed germination. When the plant embryo emerges from the seed, the radicle of the embryo forms the root system [53].

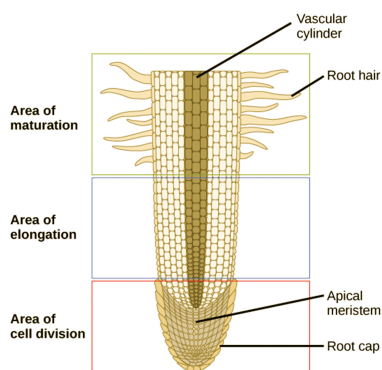


Figure 4. Three zones of the root tip [53]

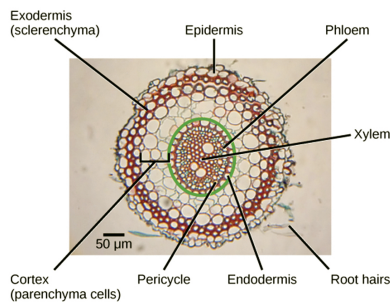


Figure 5. Cross section of wheat root (Triticum) [53]

Early root growth is one of the functions of the apical meristem located near the tip of the root. Growth from apical meristems is known as primary growth, which encompasses all elongation. Secondary growth encompasses all growth in diameter. Secondary growth occurs at the lateral meristems, namely the vascular cambium and cork cambium. The former forms secondary xylem and secondary phloem, while the latter forms the periderm [51].

To develop in this manner, a root has several parts [1]. The tip of the root is protected by the root cap, a structure exclusive to roots and unlike any other plant structure. The root cap is continuously replaced because it gets damaged easily as the root pushes through soil [53].

The root tip can be divided into three zones: a zone of cell division, a zone of elongation, and a zone of

maturation and differentiation (Figure 4). The zone of cell division is closest to the root tip; it is made up of the actively dividing cells of the root meristem. The zone of elongation is where the newly formed cells increase in length, thereby lengthening the root. Virtually all increase in root length occurs in the elongation region [1,53]. Beginning at the first root hair is the zone of cell maturation where the root cells begin to differentiate into special cell types. All three zones are in the first centimeter or so of the root tip.

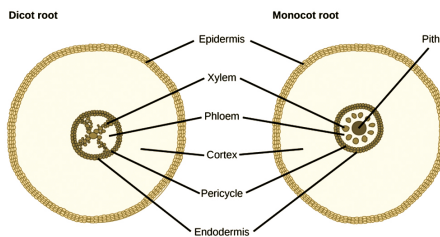


Figure 6. Xylem and phloem in the roots of dicotyledonous and monocotyledonous [53]

The root has an outer layer of cells called the epidermis. The epidermis provides protection and helps in absorption. Root hairs, which are extensions of root epidermal cells, increase the surface area of the root, greatly contributing to the absorption of water and minerals [53].

Root hairs are organs that grow within days when water, temperature, and soluble essential elements are at optimum levels. Root hairs die and are shed after a few weeks. Firs, redwoods, and Scots pine do not have root hairs. Instead, they absorb water and nutrients through the thin-walled epidermis. In contrast, some trees such as the redbud and honeylocust have root hairs that last for several years [1].

Inside the root, the ground tissue forms two regions: the cortex and the pith (Figure 5). Compared to stems, roots have lots of cortex and little pith. The cortex is between the epidermis and the vascular tissue, whereas the pith lies between the vascular tissue and the center of the root [53].

Root cortex is composed of loosely packed round tissue cells with large diameters. The inner layer of cortex is the endodermis. Within the cortex are the xylem, phloem, and pericycle. In dicot roots, the xylem and phloem of the stele are arranged alternately in an X shape, whereas in monocot roots, the vascular tissue is arranged in a ring around the pith (Figure 6) [1,53].

## II. Learn the following words and word - combinations.

|                  |                                  |
|------------------|----------------------------------|
| apical meristem  | апикальна (верхівкова) меристема |
| lateral meristem | бічна меристема                  |
| primary growth   | первинний ріст                   |
| secondary growth | вторинний ріст                   |
| vascular cambium | судинний камбій                  |
| cork cambium     | пробковий камбій                 |
| root cortex      | коренева кора                    |

|               |                    |
|---------------|--------------------|
| periderm      | перидерма          |
| pericycle     | перицикл           |
| endogenous    | ендогенний         |
| exogenous     | екзогенний         |
| pith          | серцевина          |
| cross section | поперечний переріз |

### III. Match the following words and word - combinations.

|                          |                                          |
|--------------------------|------------------------------------------|
| a) seed germination      | 1) поділ клітини                         |
| b) root cap              | 2) судинна клітина                       |
| c) cell division         | 3) меристема (утворююча тканина) коріння |
| d) outer layer           | 4) проростання насіння                   |
| e) phloem                | 5) зародковий корінець                   |
| f) vascular tissue       | 6) ксилема                               |
| g) cell maturation       | 7) кореневий чохлак                      |
| h) radicle of the embryo | 8) зовнішній шар                         |
| i) xylem                 | 9) дозрівання клітини                    |
| j) root meristem         | 10) флоема                               |

### IV. Show general understanding of the text answering the questions.

1. When does the growth of root begin?
2. What is a primary growth?
3. Where does secondary growth occur?
4. What parts of the plant are endogenous and what parts are exogenous?
5. How is the tip of the root protected?
6. How is the root tip divided?
7. What is the zone of cell made up?
8. In what zone do the root cells begin to differentiate into special cell types?
9. What is epidermis and what are its functions?
10. When do root hairs grow?

### V. Agree or disagree with the following statements.

1. The root system is formed by the radicle of the embryo.
2. The root cap rarely gets damaged as the root pushes through soil.
3. The zone of elongation is made up of the actively dividing cells.
4. The zone of cell maturation begins at the first root.
5. The epidermis surrounds areas of ground tissue and vascular tissue.
6. Root hairs increase the surface area of the root.

7. Some trees such as the redbud and honeylocust do not have root hairs.
8. When the root pushes through soil it gets damaged easily and that's the reason why the root cap is continuously replaced.
9. The inner layer of cortex is the endodermis.

**VI. Fill in the blanks with the correct words and phrases from the word bank.**

**Word bank - cap, division, pericycle, ground tissue, cell, root, apical meristem, tip.**

1. Early root growth is one of the functions of the ....
2. Cell .... occurs in the apical meristem.
3. The root .... is a structure exclusive to roots.
4. The root .... can be divided into three zones.
5. The zone of .... division is closest to the root tip.
6. Root hairs are extensions of .... epidermal cells.
7. Inside the root, the .... forms two regions: the cortex and the pith.
8. Within the cortex are the xylem, phloem and ....

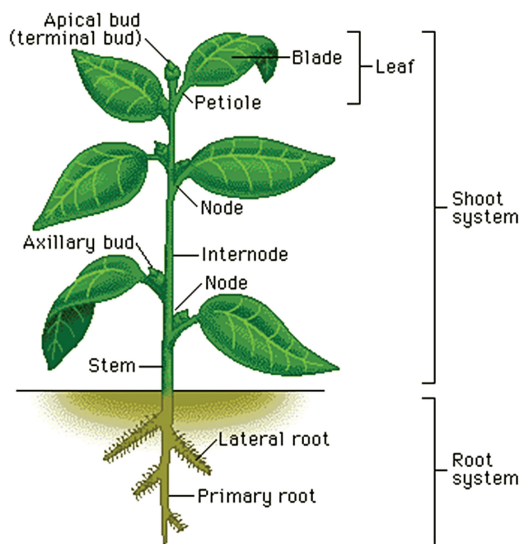
## **Text 8**

### **Stem**

**I. Read and translate the text.**

Stems are a part of the shoot system of a plant. They may range in length from a few millimeters to hundreds of meters, and also vary in diameter, depending on the plant type. Stems are usually above ground, although the stems of some plants, such as the potato, also grow underground. Stems may be herbaceous (soft) or woody in nature.

Their main function is to provide support to the plant, holding leaves, flowers and buds; in some cases, stems also store food for the plant. A stem may be unbranched, like that of a palm tree, or it may be highly branched, like that of an apple tree. The stem of the plant connects the roots to the leaves, helping to transport absorbed water and minerals to different parts of the plant. It also helps to transport the products of photosynthesis, namely sugars, from the leaves to the rest of the plant [54].



**Figure 7. Parts of a Stem [46]**

Plant stems, whether above or below ground, are characterized by the presence of nodes and internodes (Figure 7). Nodes are points of attachment for leaves, aerial roots, and flowers. The stem region between two nodes is called an internode. The stalk that extends from the stem to the base of the leaf is the petiole. An axillary bud is usually found in the axil - the area between the base of a leaf and the stem - where it can give rise to a branch or a

flower. The apex (tip) of the shoot contains the apical meristem within the apical bud [54].

Production of new living tissue is the other function of the stem. The normal lifespan of plant cells is one to three years. Stems have cells called meristems that annually generate new living tissue [44].

Many environmental factors can influence stem growth. Plants that grow in light that comes from one side (instead of from the top) tend to bend toward the light, a process called phototropism. Plants that grow in complete darkness tend to have stems that are abnormally long and thin and are yellow in color. Such stems are said to be etiolated [59].

There are thousands of species whose stems have economic uses. Stems provide a few major staple crops such as potato and taro. Sugarcane stems are a major source of sugar. Maple sugar is obtained from trunks of maple trees. Vegetables from stems are asparagus, bamboo shoots, cactus pads or nopales, kohlrabi, and water chestnut. The spice cinnamon is bark from a tree trunk.

Wood is used in thousands of ways, e.g. buildings, furniture, boats, airplanes, wagons, musical instruments, sports equipment. Tree bark is often used as a mulch and in growing medium for container plants [44].

## II. Learn the following words.

|                 |                              |
|-----------------|------------------------------|
| node            | вузол                        |
| internode       | міжвузля                     |
| petiole         | черешок                      |
| stalk           | стебло                       |
| axillary bud    | пазухова брунька             |
| taro            | бот. таро, колоказія їстівна |
| axil            | пазуха листа                 |
| apical bud      | верхівкова брунька           |
| shoot           | паросток, пагін              |
| apical meristem | верхівкова меристема         |
| cinnamon        | кориця                       |

## III. Match the following words.

|                     |                                    |
|---------------------|------------------------------------|
| a) sugarcane stem   | 1) деревне стебло                  |
| b) maple sugar      | 2) контейнерні рослини             |
| c) bamboo shoots    | 3) водний каштан                   |
| d) cactus pads      | 4) стебло цукрового очерета        |
| e) water chestnut   | 5) основне джерело                 |
| f) container plants | 6) основні культури                |
| g) growing medium   | 7) субстрат для вирощування рослин |
| h) woody stem       | 8) кленовий цукор                  |
| i) staple crops     | 9) кактусові лапки                 |
| j) major source     | 10) пагони бамбука                 |

## IV. Show general understanding of the text answering the questions.

1. What is an internode?
2. What connects the leaf to the stem?
3. How do stems differ?
4. What is the main function of the stem?
5. What is the axil?
6. What types of cells are tissues formed from?
7. What process is called phototropism?
8. What do plants that grow in complete darkness look like?

## V. Agree or disagree with the following statements.

1. Areas where leaves are attached to the plant are called internodes.
2. Leaf connects to the stem with the help of petiole.
3. Mostly stems are above ground.
4. The main function of stems is to store food for the plant.
5. Stem transports water and minerals to different parts of the plant.

6. Nodes are points where leaves, aerial roots, and flowers are attached to the stem.
7. The normal lifespan of plant cells is two to six years.
8. Asparagus, bamboo shoots and water chestnut are vegetables from stems.

**VI. Fill in the blanks with the correct words and phrases from the word bank.**

**Word bank – woody, stalk, shoot, leaves, meristems, magnolia, plant, buds.**

1. The leaves just above the nodes arose from axillary.....
2. Stems are a part of the .... system of a plant.
3. Stems vary in diameter, depending on the .... type.
4. Stems may be herbaceous (soft) or .... in nature.
5. A stem may be highly branched, like that of a .... tree.
6. Stem helps to transport the products of photosynthesis, namely sugars, from the .... to the rest of the plant.
7. The .... that extends from the stem to the base of the leaf is the petiole.
8. Cells called .... annually generate new living tissue.

**VII. Match the words (1- 3) with the definitions (A-C).**

- 1 - leaf
- 2 - stem
- 3 - bud

A) .... is the long, narrow part of a plant that supports the leaves and flowers.

B) .... is the small part of a plant that grows from the stem or branch and develops into a leaf or flower.

C) .... is the flat part of a plant that grows from the stem or branch.

## **Text 9**

### **Stem Modifications**

**I. Read and translate the text.**

In some plants the stems are modified to perform the function of storage of food, support, protection and vegetative propagation:

\*for food storage: rhizome (ginger), tuber (potato), bulb (onion), corm (colocasia);

\*for support: stem tendrils of watermelon, grapevine, cucumber;

\*for protection: axillary buds of stem of citrus, bougainvillea get modified into pointed thorns; they protect the plants from animals;

\*for vegetative propagation: underground stems of grass, strawberry, lateral branches of mint and jasmine;

\*for assimilation of food: flattened stem of opuntia contains chlorophyll and performs photosynthesis [32].

Some plant species have modified stems that are especially suited to a particular habitat and environment. A rhizome is a modified stem that grows horizontally underground and has nodes and internodes. Vertical shoots may arise from the buds on the rhizome of some plants, such as ginger and ferns.

Corms are similar to rhizomes, except they are more rounded and fleshy (such as in gladiolus). Corms contain stored food that enables some plants to survive the winter. Stolons are stems that run almost parallel to the ground, or just below the surface, and can give rise to new plants at the nodes.

Runners are a type of stolons that runs above the ground and produces new clone plants at nodes at varying intervals: strawberries are an example. Tubers are modified stems that may store starch, as seen in the potato. Tubers arise as swollen ends of stolons, and contain many adventitious or unusual buds (familiar to us as the “eyes” on potatoes). A bulb, which functions as an underground storage unit, is a modification of a stem that has the appearance of enlarged fleshy leaves emerging from the stem or surrounding the base of the stem, as seen in the onion [45].

Some aerial modifications of stems are tendrils and thorns. Tendrils are slender, twining strands that enable a plant (like a vine or pumpkin) to seek support by climbing on other surfaces. Thorns are modified branches appearing as sharp outgrowths that protect the plant; common examples include roses, pumpkin, acacia [45].

## II. Learn the following words.

|              |                                   |
|--------------|-----------------------------------|
| habitat      | природне середовище               |
| rhizome      | кореневище                        |
| ginger       | імбир                             |
| fern         | папороть                          |
| corm         | бульбоцибулина                    |
| stolons      | столони                           |
| runner       | відводок, вусик, повзучий пагін   |
| tuber        | бульба                            |
| starch       | крохмаль                          |
| swollen ends | набряклі кінці                    |
| tendril      | вусик (горох), плодоніжка (кавун) |
| thorn        | шип, колючка                      |

### **III. Show general understanding of the text answering the questions.**

1. What function do modified stems perform in some plants?
2. What stem grows horizontally underground?
3. What is the difference between corms and rhizomes?
4. What stem runs almost parallel to the ground or just below the surface?
5. What stems may store starch?
6. What does a bulb look like?
7. What are aerial modifications of stems?

### **IV. Agree or disagree with the following statements.**

1. Pointed thorns protect the plants from animals.
2. Ginger and ferns have vertical shoots that arise from the buds on the rhizome.
3. Corms are different to rhizomes.
4. Stored food containing in corms enables some plants to survive the winter.
5. Stolons are stems that can give rise to new plants from the bulbs.
6. Runners are a type of stolon that runs underground.
7. Tubers contain many adventitious or unusual buds.

### **V. Fill in the blanks with the correct words and phrases from the word bank.**

**Word bank – clone plants, habitat, swollen ends, storage, rounded, internodes.**

1. Modified stems suit to a particular .... and environment.
2. A rhizome is a modified stem that has nodes and ....
3. Corms are more .... and fleshy.
4. Runners are a type of stolon that produces new .... at nodes at varying intervals.
5. Tubers arise as .... of stolon.
6. A bulb functions as an underground .... unit.

### **VI. Match the words (1- 3) with the definitions (A-C).**

1. - cloning
  2. - tuber
  3. - storage
- A) .... is the act of keeping something somewhere while it is not in use.
- B) .... is the process of copying a biological organism or part of that organism.
- C) .... is an edible part that grows completely underground.

## **Text 10**

### **Leaves**

#### **I. Read and translate the text.**

The term leaf refers to the organ that forms the main lateral appendage on the stem of vascular plants. Leaves are the main sites for photosynthesis: the process by which plants synthesize food. Although photosynthesis typically only occurs on the upper surface of the leaf, it can occur on both sides in some plant species [3,54].

The thickness, shape, and size of leaves are adapted to the environment. Each variation helps a plant species maximize its chances of survival in a particular habitat [54]. In southern Africa there is a plant called the tree tumbo, which only has two leaves in its whole life. Each leaf can be over 27 ft. In one year, the Amazon water lily produces leaves that are 8 ft in diameter - a child can stand on one leaf. On the other hand, the leaves of the watermeal plant are only 1 millimeter across [4].

Usually, the leaves of plants growing in tropical rainforests have larger surface areas than those of plants growing in deserts or very cold conditions [54]. The fleshy leaves of desert plants store water, while some desert plants reserve moisture by having few or no leaves. Many other desert trees and shrubs have also adapted by eliminating leaves - replacing them with spines that help the plant collect moisture, provide shade and protect the plant [11,27]. Many gymnosperms have thin needle-like or scale-like leaves that can be advantageous in cold climates with frequent snow and frost [29].

Although leaves are typically located above ground, some species have leaves which reside underground (e.g., bulb scales) or underwater (e.g., aquatic plant species). Moreover, the leaves of some plants may not be associated with photosynthesis (e.g., asparagus) [3].

Most leaves are usually green, due to the presence of chlorophyll in the leaf cells. However, some leaves may have different colors, caused by other plant pigments that mask the green chlorophyll [54]. In cold autumns, they sometimes change color, and turn yellow, bright-orange, or red, as various accessory pigments (carotenoids and xanthophylls) are revealed when the tree responds to cold and reduced sunlight by curtailing chlorophyll production [29].

## II. Learn the following words and word - combinations.

|                       |                   |
|-----------------------|-------------------|
| lateral appendage     | бічний відросток  |
| vascular plants       | судинні рослини   |
| tropical rainforests  | тропічні ліси     |
| bulb scales           | луски цибулини    |
| aquatic plant species | водні види рослин |
| carotenoids           | каротиноїди       |
| xanthophylls          | ксантофіли        |
| spines                | колючки           |
| asparagus             | спаржа            |

## III. Show general understanding of the text answering the questions.

1. What organ forms the main lateral appendage on the stem of vascular plants?
2. What process causes plants to synthesize food?
3. What helps plant species maximize its chances of survival and why?
4. How do desert trees and shrubs collect moisture in deserts?
5. What kind of leaves do gymnosperms have?
6. Where can leaves be located?
7. What factor makes leaves green?

## IV. Agree or disagree with the following statements.

1. Such features of the leaf as thickness, shape, and size of leaves can adapt to the environment.
2. Photosynthesis typically occurs on the upper surface of the leaf.
3. Leaves of plants growing in deserts or very cold conditions have larger surface areas than the leaves of plants growing in tropical rainforests.
4. The leaves of asparagus are associated with photosynthesis.
5. Leaves are usually green, due to the absence of chlorophyll in the leaf cells.
6. Accessory pigments (carotenoids and xanthophylls) are revealed when the tree responds to cold and reduced sunlight.

## V. Fill in the blanks with the correct words and phrases from the word bank.

**Word bank**– surface, underwater, green, different, sides.

1. Plant pigments mask the .... chlorophyll.
2. Photosynthesis can occur on both .... in some plant species.
3. Leaves of plants growing in deserts or very cold conditions have a smaller .... area to minimize water loss.
4. Most leaves are usually green but some leaves may have .... colors.
5. Aquatic plant species have leaves which reside ....

## Text 11

### Structure of a Typical Leaf

#### I. Read and translate the text.

Leaves are typically comprised of a distinct upper and lower surface, stomata for gas exchange, waxy coating, hairs and venation [3]. Each side of the leaf differs in regarding the level to which these features are expressed. Each leaf typically has a leaf blade called the lamina, which is also the widest part of the leaf.

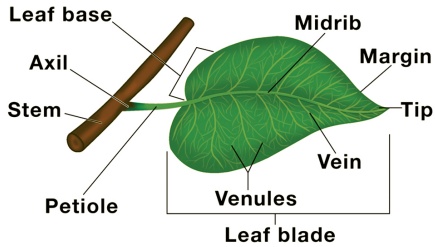


Figure 8. Parts of a leaf with their structure [36]

Some leaves are attached to the plant stem by a petiole (Figure 8). Leaves that do not have a petiole and are directly attached to the plant stem are called sessile

leaves (for example, corn).

Small green appendages usually found at the base of the petiole are known as stipules. Most leaves have a midrib, which travels the length of the leaf and branches to each side to produce veins of vascular tissue. The edge of the leaf is called the margin [54].

Within each leaf, the vascular tissue forms veins. The arrangement of

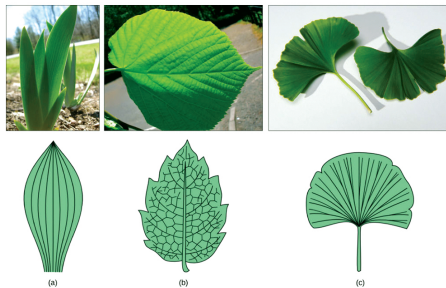


Figure 9. (a) Tulip (*Tulipa*), a monocot, has leaves with arc venation. The netlike venation in this (b) linden (*Tilia cordata*) leaf distinguishes it as a dicot. The (c) *Ginkgo biloba* tree has dichotomous venation

veins in a leaf is called the venation pattern. Monocots and dicots differ in their patterns of venation (Figure 9). Monocots have parallel or arc venation; the veins run in straight lines across the length of the leaf. In dicots,

however, the veins of the leaf have a net-like appearance, forming a pattern known as reticulate venation. One extant plant, the *Ginkgo biloba*, has dichotomous venation where the veins fork [54].

The outermost layer of the leaf is the epidermis; it is present on both sides of the leaf and is called the upper and lower epidermis, respectively. Botanists call the upper side the adaxial surface (or adaxis) and the lower side the abaxial surface (or abaxis). The epidermis helps in the regulation of gas exchange. It contains stomata: openings through which the exchange of gases takes place. The epidermis is usually one cell layer thick; however, in plants that grow in very hot or very cold conditions, the epidermis may be several layers thick to protect against excessive water loss from transpiration. A waxy layer known as the cuticle covers the leaves of all plant species.

Below the epidermis of dicot leaves are layers of cells known as the mesophyll, or «middle leaf». The mesophyll of most leaves typically contains two arrangements of parenchyma cells: the palisade parenchyma and spongy parenchyma [54].

## II. Learn the following words.

|                |                                     |
|----------------|-------------------------------------|
| lamina         | листова пластинка                   |
| sessile leaves | сидячий листок (листок без черешка) |
| stipule        | прилистник                          |
| midrib         | центральна жилка листя              |
| vein           | бічна жилка                         |
| margin         | край листової пластини              |
| venation       | жилкування                          |
| petiole        | черешок                             |
| veins          | прожилки                            |
| fork           | роздвоюватись                       |
| stomata        | продихи                             |
| converge       | сходитися, співпадати               |
| cuticle        | кутикула                            |

## III. Match the following word – combinations.

|                         |                                      |
|-------------------------|--------------------------------------|
| a) reticulate venation  | 1) дихотомічне (вилчасте) жилкування |
| b) dichotomous venation | 2) дугове жилкування                 |
| c) palisade parenchyma  | 3) губчаста паренхіма                |
| d) abaxis               | 4) лопать листка                     |
| e) parallel venation    | 5) адаксіальний                      |
| f) leaf blade           | 6) паралельне жилкування             |
| g) arc venation         | 7) абаксіальний                      |
| h) spongy parenchyma    | 8) стовпчаста паренхіма              |
| i) adaxis               | 9) сітчасте жилкування               |

**IV. Show general understanding of the text answering the questions.**

1. What is the leaf comprised of?
2. What part attaches the leaf to the plant stem?
1. What is the widest part of the leaf?
2. What leaves are called sessile?
3. What is the venation pattern?
4. How do monocots and dicots differ in the patterns of venation?
5. What is epidermis?
6. How does the exchange of gases in leaves take place?
7. What is the cuticle?

**V. Agree or disagree with the following statements.**

1. A leaf blade is called the petiole.
2. Leaves that do not have a petiole are called sessile leaves.
3. A midrib branches to each side of the leaf to produce veins of vascular tissue.
4. Within each leaf, the vascular tissue forms stipules.
5. A pattern known as reticulate venation is formed in dicots.
6. Monocots and dicots are similar in their patterns of venation.
7. Epidermis is present on both sides of the leaf.
8. The epidermis has usually several layers thick.
9. The palisade parenchyma and spongy parenchyma are two arrangements of parenchyma cells.

**VI. Fill in the blanks with the correct words and phrases from the word bank.**

**Word bank— edge, leaves, arrangement, epidermis, water, leaf, veins, surface.**

1. Leaves are typically comprised of a distinct upper and lower ....
2. Some .... are attached to the plant stem by a petiole.
3. A midrib travels the length of the ....
4. The .... of the leaf is called the margin.
5. The venation pattern is the .... of veins in a leaf.
6. The *Ginkgo biloba* has dichotomous venation where the .... fork.
7. The epidermis may be several layers thick to protect against excessive .... loss.
8. Below the .... of dicot leaves are layers of cells known as the mesophyll.

## Text 12

### Leave Arrangement

#### I. Read and translate the text.

The arrangement of leaves on a stem is known as phyllotaxy. The number and placement of a plant's leaves will vary depending on the species, with each species exhibiting a characteristic leaf arrangement. Leaves are classified as either alternate or spiral, opposite and whorled (Figure 10).

Plants that have only one leaf per node have leaves that are said to be either alternate - meaning the leaves alternate on each side of the stem in a flat plane - or spiral, meaning the leaves are arrayed in a spiral along the stem. In an opposite leaf arrangement, two leaves arise at the same point, with the leaves connecting opposite each other along the branch. If there are three or more leaves connected at a node, the leaf arrangement is classified as whorled [54].

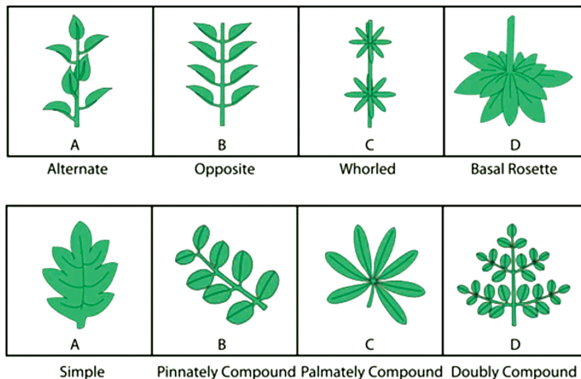


Figure 10. Leaf form [43]

**Leaf Form.**  
Leaves may be simple or compound (Figure 10). In a simple leaf, the blade is either completely undivided - as in the banana leaf - or it has lobes, but the separation does not reach the midrib, as in the maple leaf. In a compound leaf, the leaf blade is

completely divided, forming leaflets, as in the locust tree. Each leaflet may have its own stalk, but is attached to the rachis. Compound leaves may be palmate or pinnate. A palmately compound leaf (b) resembles the palm of a hand, with leaflets radiating outwards from one point. Examples include the leaves of poison ivy, the buckeye tree.

Pinnately compound leaves take their name from their feather-like appearance; the leaflets are arranged along the midrib, as in rose leaves (c) the leaves of ash, walnut trees, potatoes, tomatoes (odd-pinnate leaf), or the honey locust (d) or peas, acacia yellow which has double compound leaves, in which leaflets branch from the veins (paripinnate leaf) [54]. As it was mentioned above flowering plant leaves vary in how the leaves are arranged on the stem

and how the blade is divided. Generally, the form and arrangement of leaves maximizes light exposure while conserving water, reducing wind resistance, or benefiting the plant in some other way in its particular habitat [43]

- Leaves arranged in whorls encircle upright stems at intervals. They collect sunlight from all directions.

- Leaves arranged in basal rosettes take advantage of warm temperatures near the ground.

- Leaves arranged in alternate or opposing pairs collect light from above. They are typically found on plants with a single, upright stem.

- The blades of simple leaves are not divided. This provides the maximum surface area for collecting sunlight.

- The blades of compound leaves are divided into many smaller leaflets. This reduces wind resistance and water loss [43].

## II. Learn the adjectives.

|           |                       |
|-----------|-----------------------|
| alternate | почергове             |
| spiral    | спіральне             |
| opposite  | супротивне            |
| whorled   | мутовчасте, кільчасте |
| flat      | плоский               |
| compound  | складний              |
| palmate   | пальчастий            |
| pinnate   | перистий              |

## III. Learn the following words.

|                  |                                               |
|------------------|-----------------------------------------------|
| leaf arrangement | листокорозміщення                             |
| phyllotaxy       | філотаксис, розташування листя навколо стебла |
| houseplant       | кімнатна рослина                              |
| leaflet          | листочок                                      |
| lobe             | доля                                          |
| stalk            | черешок                                       |
| rachis           | основний черешок                              |
| radiate          | поширювати                                    |
| honey locust     | гледичія триколючкова                         |
| poison ivy       | отруйний плющ                                 |
| buckeye tree     | кінський каштан                               |
| ash              | ясен                                          |
| walnut trees     | горіх волоський                               |
| locust tree      | акація біла                                   |

#### **IV. Show general understanding of the text answering the questions.**

1. What does the number of leaves depend on?
2. How are leaves classified?
3. When is the leaf arrangement classified as whorled?
4. What is the difference between simple and compound leaves?
5. What does a palmately compound leaf resemble?
6. What is the appearance of a palmately compound leaf?

#### **V. Agree or disagree with the following statements.**

1. Phyllotaxy is the arrangement of leaves on a stem.
2. In an opposite leaf arrangement the leaves are arrayed in a spiral along the stem.
3. In a compound leaf the leaf blade is completely undivided.
4. Examples of plants with a palmately compound leaf are poison ivy and the buckeye tree.
5. In pinnately compound leaves the leaflets are arranged along the midrib.
6. Each leaflet in a compound leaf may have its own stalk.

#### **VI. Fill in the blanks with the correct words and phrases from the word bank.**

**Word bank – compound, alternate, blade, palmately, arrangement.**

1. Alternate leaves are the leaves that .... on each side of the stem in a flat plane.
2. In an opposite leaf .... two leaves arise at the same point.
3. In a simple leaf the .... is either completely undivided or it has lobes.
4. In a .... leaf the leaf blade is completely divided and forms leaflets.
5. Examples of a .... compound leaf are the leaves of poison ivy and buckeye tree.

### **Text 13**

#### **Function of the Leaf**

##### **I. Read and translate the text.**

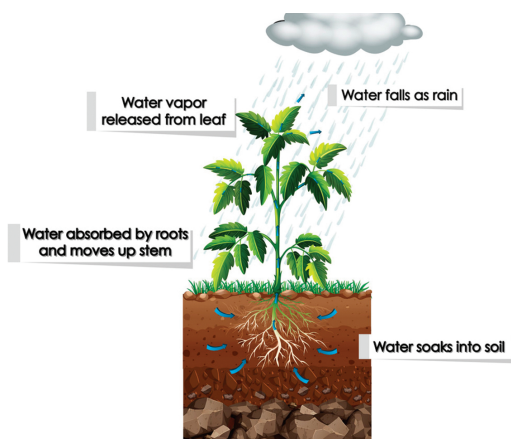
As one of the most important constituents of plants, leaves have several essential functions: photosynthesis, transpiration, guttation, storage, defense.

The primary function of the leaf is the conversion of carbon dioxide, water, and UV light into sugar (e.g., glucose) via photosynthesis. The simple sugars formed via photosynthesis are later processed into various macromolecules (e.g., cellulose) required for the formation of the plant cell

wall and other structures. Therefore, the leaf must be highly specialized to combine the carbon dioxide, water, and UV light for this process.

Carbon dioxide is diffused from the atmosphere through specialized pores, termed stomata, in the outer layer of the leaf. Water is directed to the leaves via the plant's vascular conducting system, termed the xylem. Leaves are orientated to ensure maximal exposure to sunlight, and are typically thin and flat in shape to allow sunlight to penetrate the leaf to reach the chloroplasts [3].

Chloroplasts are specialized organelles that perform photosynthesis. Once sugar is formed from photosynthesis, the leaves function to transport it down the plant via specialized structures called the phloem, which run in parallel to the xylem. The sugar is typically transported to the roots and shoots of the plant, to support growth.



**Figure 11. Transpiration [13]**

Transpiration is the process of water movement through a plant and its evaporation from aerial parts, such as leaves, stems and flowers (Figure 11) [63]. When the stomata open to accommodate the diffusion of carbon dioxide into the plant for photosynthesis, water flows out. This process also serves to cool the plant via

evaporation of the water from the leaf, as well as regulate the plant's osmotic pressure [3].

Guttation process is observed the most when transpiration is suppressed (Table 1) [15]. Guttation refers to the excretion of xylem from the edges of leaves and other vascular plants due to increased levels of water in the soil at night, when the stomata are closed. The pressure caused at the roots results in the leakage of water from the xylem out of specialized water glands at the edges of leaves [3]. As water from soil passes through the guttation process, it picks up minerals, enzymes and other chemicals and is called xylem sap.

Guttation happens in certain plants that have vascular systems, such as grass, wheat, barley, tomatoes, strawberries, and other small plants. Since

guttation relies on pressure, it can't occur in large plants, such as trees, because the pressure required to force the water out is too large [23].

**Table 1. Some of the major differences between Guttation and Transpiration which make them two distinct phenomena [15]**

| <b>Guttation</b>                             | <b>Transpiration</b>                 |
|----------------------------------------------|--------------------------------------|
| Water lost in guttation is rich in minerals. | The transpired water is pure.        |
| Water is lost as the liquid.                 | Water is lost in the form of vapors. |
| The process takes place through hydathodes.  | Stomata perform this process.        |

Leaves are a primary site of water and energy storage since they provide the site of photosynthesis. Succulents are particularly adept at water storage, as evidenced by the thick leaves. Due to the high levels of nutrients and water, many animal species ingest the leaves of plants as a source of food.

Some leaves have also evolved defense mechanisms to avoid being eaten or damaged. Some examples include the spines of cacti, cones of gymnosperms, respectively. In addition, hairs found on leaves (trichomes) prevent water loss in dry climates and sting animals that detour herbivores (e.g., *Urticaceae*). Moreover, the waxy coatings found on leaves serve to protect against water loss, rain, and forms of contamination. Oils and other secreted substances also detract from being consumed by herbivores [3].

## **II. Learn the following words**

|                        |                                         |
|------------------------|-----------------------------------------|
| simple sugars          | прості цукри                            |
| leakage                | протікання, просочування                |
| vascular system        | судинна система                         |
| subsequent evaporation | подальше випаровування                  |
| osmotic pressure       | осмотичний тиск                         |
| source of food         | джерело їжі                             |
| spines of cacti        | колючки кактусів                        |
| cones of gymnosperms   | шишки голонасінних                      |
| diffusion              | поширення, розповсюдження               |
| guttation              | гутація (виділення листям крапель води) |
| phloem                 | флоема                                  |
| xylem                  | ксилема                                 |
| urticaceae             | кропивові (бот. родина)                 |

### III. Learn the following verbs.

|              |                            |
|--------------|----------------------------|
| to detract   | зменшувати                 |
| to ensure    | забезпечити                |
| to avoid     | уникати                    |
| to damage    | шкодити, завдавати збитків |
| to penetrate | проникати                  |
| to reach     | досягати                   |
| to evolve    | розвиватися                |
| to ingest    | ковтати                    |
| to evidence  | свідчити, доводити         |
| to refer     | посилатися, звертатися     |
| to flow out  | витікати, випливати        |

### IV. Show general understanding of the text answering the questions.

1. What is the primary function of the leaf?
2. What process helps form simple sugars?
3. How is water directed to the leaves?
4. Typical leaves are thin and flat. Why?
5. What organelles perform photosynthesis?
6. What is transpiration?
7. What is guttation and why does it happen?
8. How is the plant cooled?
9. Leaves are a primary site of water and energy storage. Why?

### V. Agree or disagree with the following statements.

1. Macromolecules are required for the formation of the plant cell wall.
2. Oxygen is diffused from the atmosphere through specialized pores, termed stomata.
3. Leaves are orientated to ensure maximal exposure to sunlight.
4. The leaves function to transport sugar down the plant via specialized structures called the xylem.
5. Transpiration is the movement of water through the plant.
6. Guttation occurs due to increased levels of water in the soil at night.
7. Animals eat the leaves of plants due to the high level of nutrients and water.
8. Guttation can't occur in large plants, such as trees.

### VI. Fill in the blanks with the correct words and phrases from the word bank.

**Word bank – leaves, water, vascular, roots, photosynthesis.**

1. The simple sugars formed via .... are later processed into various macromolecules.

2. Water is directed to the .... via the plant's vascular conducting system, termed the xylem.
3. The sugar is typically transported to the .... of the plant, to support growth.
4. The task of transpiration is to evaporate .... via the leaves.
5. Guttation happens in certain plants that have .... systems.

**VII. Give examples of defense mechanisms which some leaves have evolved.**

## **Text 14**

### **Flower**

#### **I. Read and translate the text.**

External plant structures such as leaves, stems, roots, flowers, fruits and seeds are known as plant organs. Each organ is an organized group of tissues that works together to perform a specific function. These structures can be divided into two groups: sexual reproductive and vegetative. Sexual reproductive parts produce seed; they include flower buds, flowers, fruit and seeds.

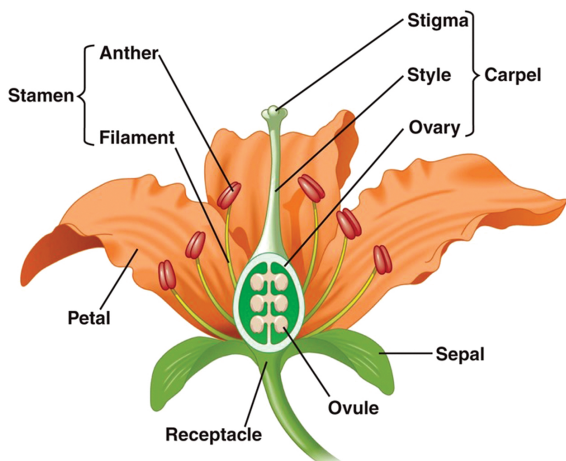
Sexual reproduction is the sole function of flowers, often the showiest part of a plant. Flowers' beauty and fragrance evolved not to please humans but to attract pollinators (insects or birds), which are central to the reproductive process.

Flowers also help classify plants. The system of plant nomenclature we use today was developed by Carl von Linné (Linnaeus) and is based on flowers, reproductive parts of plants or both. One reason his system is successful is that flowers are the plant part least influenced by environmental changes. Thus, a knowledge of flowers and their parts is essential for anyone interested in plant identification [34].

Flowers are formed during the reproductive period of plants. The process of flower production is called flowering. As any other plant organ, flowers are developed by a meristem activity. The flower is connected with the stem by the peduncle and flowers lacking peduncle are called sessiles. At the distal part, the peduncle, or pedicel, forms a terminal structure referred as receptacle, where other components of the flower are inserted [41].

A typical flower has 4 components: sepals, petals, stamens and pistils (carpels) (Figure 12). Sepals are small, green, leaflike structures located at the base of a flower [34, 41].

They protect the flower bud. Collectively, the sepals are called a calyx. Petals generally are the highly colored portions of a flower. Like nectar glands, petals may contain perfume. Collectively, the petals are called a corolla.



**Figure 12. Parts of a flower with their structure [33]**

The number of petals on a flower often is used to help identify plant families and genera. Flowers of dicots typically have four or five sepals, petals or multiples thereof. In monocots, these floral parts typically come in threes or multiples of three [34].

Calyx (sepals) and corolla (petals)

form the perianth. The perianth is the non-reproductive part of the flower that has a protection function or helps during fertilization [41].

The reproductive part composes of the androecium (group of stamens) and the gynoecium (carpels, pistil) [41]. The stamen is the male reproductive organ. It consists of a pollen sac (anther) and a long supporting filament. This filament holds the anther in position, making the pollen available for dispersal by wind, insects, or birds [34].

The pistil is a plant's female part. It generally is shaped like a bowling pin and is located in the flower's center. It consists of a stigma, style and ovary. The stigma is located at the top and is connected by the style to the ovary. The ovary contains eggs, which reside in ovules. If an egg is fertilized, the ovule develops into a seed [34].

## II. Learn the following words

|                  |                                           |
|------------------|-------------------------------------------|
| peduncle         | квітконіжка, плодоніжка                   |
| sessile          | бесчерешковий, сидячий                    |
| receptacle       | квітколоже                                |
| sepal            | чашолисток                                |
| stamen           | тичинка                                   |
| pistil (carpels) | маточка, прилисток (карпель, плодолисток) |
| calyx            | чашечка                                   |

|            |                                    |
|------------|------------------------------------|
| corolla    | віночок                            |
| genera     | сорт, вид                          |
| perianth   | оцвітина                           |
| androceium | андроцей, чоловіча частина квітки  |
| gynoecium  | гінецей, жіноча частина квітки     |
| pollen sac | пилковий мішок                     |
| anther     | пильниця, пиляк                    |
| filament   | філамент, нитка тичинки, волокнина |
| stigma     | стигма, рильце                     |
| style      | стовпчик                           |
| carpel     | плодолист                          |

### III. Match the following words.

|               |                    |
|---------------|--------------------|
| a) flower bud | 1) запилювач       |
| b) fruit      | 2) частина         |
| c) seed       | 3) квітковий бутон |
| d) part       | 4) пташка          |
| e) fragrance  | 5) комаха          |
| f) pollinator | 6) плід            |
| g) insect     | 7) аромат          |
| h) bird       | 8) насіння         |

### IV. Show general understanding of the text answering the questions.

1. What plant organs do you know?
2. How can external plant structures be divided?
3. What is the sole function of flowers?
4. What is the main idea of Linnaeus plant nomenclature concerning the flower?
5. What is flowering?
6. What flowers are called sessiles?
7. Where is the receptacle formed?
8. What are the components of the typical flower?
9. What part of flower protects the flower bud?
10. What part of flower helps identify plant families?
11. What is the function of the perianth?
12. Where is the stigma located?
13. What are the male and female reproductive organs?
14. What do they consist of?
15. What is the function of the filament?

**V. Agree or disagree with the following statements.**

1. Each organ of plant works together to perform a specific function.
2. Flower buds, flowers, fruit and seeds are the parts of vegetative structure.
3. Flower is the showiest part of a plant.
4. Flowers' beauty and fragrance evolved to please humans.
5. Flowers are developed by a meristem activity.
6. The flower is connected with the stem by the receptacle.
7. The components of the flower are inserted in the receptacle.
8. Sepals are located at the base of a flower.
9. Sepals generally are the highly colored portions of a flower.
10. The perianth is the non-reproductive part of the flower.
11. The perianth is formed of calyx and corolla.
12. The stamen generally is shaped like a bowling pin.
13. The stigma is connected by the style to the ovary.
14. The ovule develops into a seed when the egg is fertilized.

**VI. Fill in the blanks with the correct words and phrases from the word bank.**

**Word bank – organ, classify, seed, corolla, flower's, leaflike, androecium, stigma, pollen sac, dicots, calyx, reproductive, stem.**

1. Sexual reproductive parts produce ....
2. Each plant .... is an organized group of tissues.
3. Flowers also help .... plants.
4. Flowers are formed during the .... period of plants.
5. The flower is connected with the .... by the peduncle.
6. Sepals are small, green.... structures.
7. Collectively, the sepals are called a....
8. Collectively, the petals are called a ....
9. Flowers of.... typically have four or five sepals.
10. The reproductive part composes of the.... (group of stamens) and the gynoecium.
11. The stamen consists of a .... (anther) and a long supporting filament.
12. The pistil is located in the .... center.
13. The.... is located at the top.

## Text 15

### Types of Flowers

#### I. Read and translate the text.

If a flower has a stamen, pistil, petals, and sepals, it is called a complete flower. Roses are an example. If one of these parts is missing, the flower is called incomplete [34].

The stamen and pistil are the essential parts of a flower and are involved in seed production. If a flower contains both functional stamens and pistils, it is called a perfect flower, even if it does not contain petals and sepals. If either stamens or pistils are lacking, the flower is called imperfect (Figure 13).

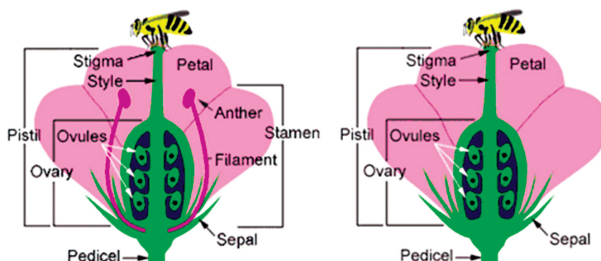


Figure 13. Complete flower structure compared to imperfect (pistillate) flower structure [50]

Pistillate (female) flowers possess a functional pistils but lack stamens. Staminate (male) flowers contain stamens, but no pistils. Plants with imperfect flowers are further classified as monoecious or dioecious [34].

Monoecious plants have separate male and female flowers on the same plant (e.g., corn and cucumber). Some monoecious plants bear only male flowers at the beginning of the growing season, but later develop both sexes (e.g., cucumbers and squash) [34].

Dioecious species have separate male and female plants. Examples include asparagus, ginkgo, holly and pistachio. In order to set fruits, male and female plants must be planted close enough together for pollination to occur. In some instances (e.g., holly), the fruit is desirable. In the case of ginkgo, however, the fruit generally is not desirable due to its putrid smell when ripe. Gourds (melon, water melon, squash) are unique because they may have one plant with bisexual flowers and female flowers and male flowers.

Some plants bear only one flower per stem, which is called a solitary flower. Other plants produce an inflorescence – a cluster of flowers [34].

The stem holding the whole inflorescence is called a peduncle and the major axis (incorrectly referred to as the main stem) holding the flowers or more branches within the inflorescence is called the rachis. The stalk of each single flower is called a pedicel. Any flower in an inflorescence is called a floret, especially when the individual flowers are particularly small and borne in a tight cluster [26].

Most inflorescences belong to one of two groups: simple and compound. In the simple group, the florets start blooming from the bottom of the stem and progress toward the top [34]. Simple inflorescences are the basis for compound inflorescences. The single flowers are there replaced by a simple inflorescence. Compound inflorescences are composed of branched stems and can involve complicated arrangements that are difficult to trace back to the main branch [26].

## II. Match the following word – combinations.

|                                |                                        |
|--------------------------------|----------------------------------------|
| a) perfect flower              | 1) зав'язувати плоди                   |
| b) imperfect flower            | 2) чоловіча квітка (утворююча тичинки) |
| c) pistillate (female) flowers | 3) двостатева (досконала) квітка       |
| d) staminate (male) flowers    | 4) дводомна рослина                    |
| e) monoecious plant            | 5) недосконала, одностатева клітка     |
| f) dioecious plant             | 6) поодинокі, окрема квітка            |
| g) set fruits                  | 7) жіноча квітка                       |
| h) solitary flower             | 8) однодомна рослина                   |

## III. Learn the following words.

|                  |                                   |
|------------------|-----------------------------------|
| pollination      | запилення                         |
| inflorescence    | цвітіння, суцвіття                |
| floret           | квіточка, окрема квітка суцвіття  |
| cluster          | гроно                             |
| bottom           | низ, основа                       |
| ginkgo           | гінкго                            |
| holly            | остролист, падуб                  |
| blooms           | цвіт, цвітіння                    |
| bisexual flowers | гермафродитні (двостатеві) квітки |
| pedicel          | квітконіжка, плодоніжка           |
| rachis           | рахіс                             |
| peduncle         | квітконіжка, плодоніжка           |
| holly            | падуб                             |
| pistil           | маточка                           |

**IV. Show general understanding of the text answering the questions.**

1. What flower is called a complete flower?
2. What parts of a flower are involved in seed production?
3. What flower is perfect?
4. How do pistillate (female) and staminate (male) flowers differ?
5. How are plants with imperfect flowers classified?
6. What are the examples of dioecious species?
7. Why are gourds unique?
8. What flower is called a floret?
9. What is the difference between simple and compound groups of inflorescences?

**V. Agree or disagree with the following statements.**

1. The flower is called incomplete when one of its parts is missing.
2. The flower is called imperfect if it lacks stamens or pistils.
3. Monoecious plants have separate male and female flowers on the same plant.
4. Dioecious species bear only male flowers at the beginning of the growing season.
5. For successful pollination male and female plants must be planted close enough together.
6. The flower is called solitary when it is the only flower per stem.

**VI. Fill in the blanks with the correct words and phrases from the word bank**

**Word bank – petals and sepals, fruit, cluster, male and female, complete, inflorescences.**

1. Roses are an example of a .... flower.
2. A flower is called perfect even if it does not contain ....
3. Monoecious plants have separate .... flowers on the same plant.
4. In the case of ginkgo the .... generally is not desirable.
5. Some plants produce an inflorescence – a .... of flowers.
6. In a compound group of .... the top floret opens first.

## **Text 16**

### **Pollination**

#### **I. Read and translate the text.**

Pollination is the transfer of pollen from an anther to a stigma, either by wind or by pollinators [34]. Bees are a particularly important group of insect pollinators, responsible for pollinating 60–70% of the world's total flowering plant species, including nearly 900 food crops worldwide, such as apples, avocados, cucumbers, squash and others [49].

Species pollinated by insects, animals or birds often have brightly colored flowers that contain fragrance or nectar. While searching for nectar, pollinators transfer pollen from flower to flower, either on the same plant or on different plants. Plants evolved this ingenious mechanism in order to ensure their species' survival. Wind-pollinated flowers (e.g. poplar, oak, birch) often lack showy floral parts and nectar because they don't need to attract pollinators [34].

There are two types of pollination, namely, cross- and self-pollination. Cross-pollination, also called allogamy, occurs when pollen is delivered from the stamen of one flower to the stigma of a flower on another plant of the same species. Cross-pollination when followed by fertilization leads to the production of offspring with heterosis or hybrid vigor [47, 48]. The resulting seed has a broader genetic base, which may enable the population to survive under a wider range of environmental conditions. Cross-pollinated plants usually are more successful than self-pollinated plants [34].

Self-pollination is the transfer of pollen grains from an anther to a stigma of the same flower or plant. This often results in inbreeding depression where undesirable recessive traits are expressed in the offspring. Self-pollination occurs in species where pollination agents are scarce and in closed flowers where the pollination agents have limited access to the sexual structures of the flower. Cleistogamy is self-pollination that occurs before the flower opens [47,48].

Self-pollination may include autogamy, where pollen is transferred to the female part of the same flower; or geitonogamy, when pollen is transferred to another flower on the same plant. Plants adapted to self-fertilize often have similar stamen and carpel lengths. Plants that can pollinate themselves and produce viable offspring are called self-fertile. Plants that cannot fertilize themselves are called self-sterile, a condition which mandates cross-pollination for the production of offspring. Consequently, more plants reproduce by cross-pollination than by self-pollination [34,47].

## II. Learn the following words.

|               |                  |
|---------------|------------------|
| stigma        | приймочка        |
| anther        | пильниця, пиляк  |
| style         | стовпчик маточки |
| fertilization | запліднення      |
| allogamy      | алогамія         |
| cleistogamy   | клеистогамія     |
| autogamy      | автогамія        |
| geitonogamy   | гейтоногамія     |
| self-sterile  | самостерильний   |
| offspring     | нащадок, плід,   |
| stamen        | тичинка          |
| pollen        | пилек            |
| carpel        | карпель          |

## III. Match the following word – combinations.

|                             |                         |
|-----------------------------|-------------------------|
| a) cross-pollination        | 1) пилкове зерно        |
| b) pollen grain             | 2) депресія інбрідинга  |
| c) self-pollination         | 3) самостерильний       |
| d) environmental conditions | 4) самозапилення        |
| e) species' survival        | 5) самоплідний          |
| f) sperm nucleus            | 6) видо-виживання       |
| g) inbreeding depression    | 7) сперматозоїд         |
| h) self-fertile             | 8) зовнішні умови       |
| i) self-sterile             | 9) перехресне запилення |

## IV. Learn the following verbs

|              |                             |
|--------------|-----------------------------|
| to pollinate | запилювати                  |
| to search    | шукати                      |
| to transfer  | передавати, переносити      |
| to ensure    | забезпечити                 |
| to lack      | не вистачати                |
| to attract   | залучати                    |
| to reach     | досягати                    |
| to release   | звільняти, відпускати       |
| to develop   | розвивати, рости, проявляти |
| to occur     | траплятися, відбуватися     |
| to survive   | вижити, зберігатися         |
| to mandate   | тут - вимагати              |

**V. Show general understanding of the text answering the questions.**

1. How does pollination take place?
2. How do pollinators help ensure plant species' survival?
3. Why do wind-pollinated flowers often lack showy floral parts?
4. What are two types of pollination?
5. When does cross-pollination occur?
6. What plants are more successful in surviving under a wide range of environmental conditions?
7. What is self-pollination?
8. When does self-pollination occur?
9. What plants have similar stamen and carpel lengths?

**VI. Agree or disagree with the following statements.**

1. Pollination is the transfer of pollen by wind or by pollinators.
2. Wind-pollinated flowers need to attract pollinators.
3. The ovule develops into a seed in case of successful fertilization.
4. Pollen grows a long tube down the style to the ovules inside the ovary.
5. More plants reproduce by self-pollination than by cross-pollination.
6. Self-pollination occurs in species where pollination agents are scarce.
7. Plants that cannot fertilize themselves are called self-fertile.
8. When pollen is transferred to the female part of the same flower it is called autogamy.

**VII. Fill in the blanks with the correct words and phrases from the word bank**

**Word bank – ovules, insects, pollen, viable offspring, self-pollination, genetic material, bees, floral parts.**

1. Species pollinated by.... often have brightly colored flowers.
2. .... are a particularly important group of insect pollinators.
3. Wind-pollinated flowers often lack showy.... and nectar.
4. When pollen reaches the ...., it releases sperm.
5. Cross-fertilization combines .... from two parent plants.
6. Cleistogamy is .... that occurs before the flower opens.
7. Geitonogamy is when.... is transferred to another flower on the same plant.
8. Plants that can pollinate themselves and produce .... are called self-fertile.

## Text 17

### Fruit

#### I. Read and translate the text.

Fruits are the means by which angiosperms disseminate seeds. Fruits arise from fertilized flowers (Figure 14). In botany, a fruit is the ripened ovary or carpel - pericarp that contains seeds and a seed is a ripened ovule. The pericarp is often differentiated into two or three distinct layers called the exocarp (outer layer, also called epicarp), mesocarp (middle layer), and endocarp (inner layer) (Figure 15). Pericarp may be fleshy, as in berries or drupes, or dry and hard, as in nuts or as in an acorn. A nut is a type of fruit and not a seed [17,18,34].

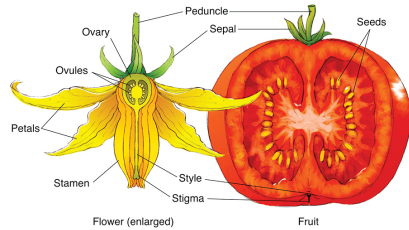


Figure 14. Flower and fruit structure

The only part of the fruit that contains genes from both the male and female flowers is the seed. The rest of the fruit arises from the maternal plant and is genetically identical to it. In some fruits, the seeds are enclosed within the ovary (e.g. apples, peaches, oranges, squash and cucumbers). In others, seeds are situated on the outside of fruit tissue (e.g. corn and strawberries) [34].

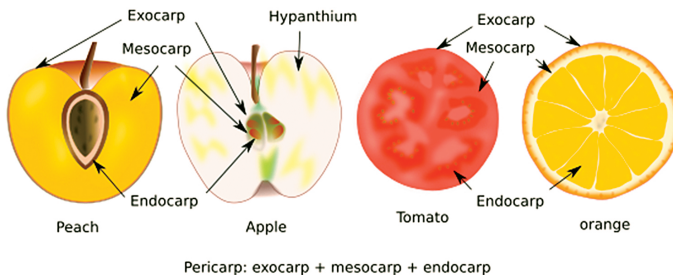


Figure 15. Different parts of the pericarp [42]

Fruits are classified as simple fruits, aggregate fruits, and composite or multiple fruits. Simple fruits can be either dry or fleshy, and result from the ripening of a simple or compound ovary in a flower with only one pistil [17]. They include fleshy fruits such as cherries and peaches (drupe), pears and apples (pome) and tomatoes (berries). Although generally referred to as a vegetable, tomatoes technically are a fruit because they develop from a flower.

Squash, cucumbers, and eggplants also develop from a single ovary and are classified botanically as fruits [34].

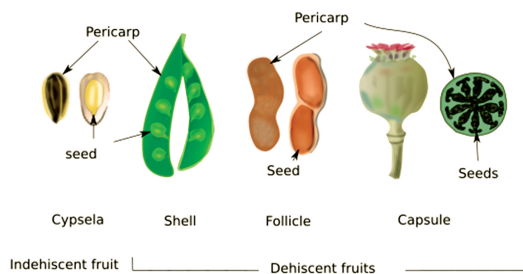


Figure 16. Types of dry fruits [42]

such as with strawberries, raspberries and blackberries. The flower of these plants is a simple flower with one corolla, one calyx and one stem but it has many pistils or ovaries. Each ovary is fertilized separately. If some ovules are not pollinated successfully, the fruit will be misshapen [34].

A multiple fruit is one formed from a cluster of flowers which are called an inflorescence. Each flower has its own calyx and corolla and produces a fruit, but these mature into a single mass. Examples are the pineapple, fig, mulberry, osageorange and breadfruit [17,34].

## II. Learn the following words.

|               |                                              |
|---------------|----------------------------------------------|
| pistil        | бот. маточка                                 |
| pericarp      | перикарпій, опліддя, навколопліддя, оплодень |
| drupes        | кістянка (тип плода)                         |
| exocarp       | екзокарпій                                   |
| mesocarp      | мезокарпій                                   |
| endocarp      | ендокарпій                                   |
| samara        | крилатка (тип плода)                         |
| capsule       | бот. коробочка                               |
| stem          | квітконос, квітконіжка, плодоніжка, стебло   |
| inflorescence | суцвіття                                     |
| osageorange   | маклюра, адамове яблуко, китайський апельсин |
| nut           | 1) горіх 2) сім'янка, плід горіха            |
| legume        | боби, біб (тип плода)                        |
| dehiscent     | 1) зневоднений, 2) що розкривається          |
| carpel        | карпель                                      |
| epicarp       | епікарп                                      |

### III. Match the following word – combinations.

|                     |                        |
|---------------------|------------------------|
| a) simple fruits    | 1) яблуко (тип плоду)  |
| b) aggregate fruits | 2) материнська рослина |
| c) multiple fruits  | 3) прості плоди        |
| d) fleshy fruits    | 4) сухий фрукт         |
| e) maternal plant   | 5) складні плоди       |
| f) dry fruit        | 6) збірні плоди        |
| g) pome             | 7) ягоди (тип плоду)   |
| h) berries          | 8) м'ясисті плоди      |

### IV. Show general understanding of the text answering the questions.

1. How is fruit classified in botany?
2. What layers has the pericarp?
3. What part of the fruit contains genes from both the male and female flowers?
4. How can fruits be classified?
5. What fruits belong to the simple fruits?
6. What does the flower of an aggregate fruit look like?
7. In what cases can the fruit be misshapen?

### V. Agree or disagree with the following statements.

1. Fruits arise from fertilized flowers.
2. A nut is a type of a seed.
3. In some fruits seeds are situated on the outside of fruit tissue.
4. Simple fruits result from the ripening of a simple or compound ovary in a flower with only one pistil.
5. Squash, cucumbers, and eggplants are classified botanically as berries.
6. Dehiscent dry fruits do not open to discharge seeds.
7. An aggregate fruit develops from a single flower with many ovaries.

### VI. Fill in the blanks with the correct words and phrases from the word bank.

#### Word bank – cherries and peaches, ovary, fruit, fleshy.

1. In botany a .... is the ripened ovary or carpel that contains seeds.
2. Pericarp may be .... , as in berries or drupes.
3. In some fruits, the seeds are enclosed within the ....
4. Simple fruits include fleshy fruits such as ....

### VII. Match the words (1- 3) with the definitions (A-C).

- 1 – seed
- 2 – flowering

3 – fruit

- A) If a plant is ..., it produces flowers.
- B) A ... is a small, usually hard, object from which a plant grows.
- C) A ... is the part of an edible plant that has seeds.

## Text 18

### Seeds

#### I. Read and translate the text.

A seed is a structure that encloses the embryo of a plant in a protective outer covering. A seed contains all of the genetic information needed to develop into an entire plant. A typical seed consists of three main parts: seed coat, endosperm and embryo (Figure 17) [37,61].

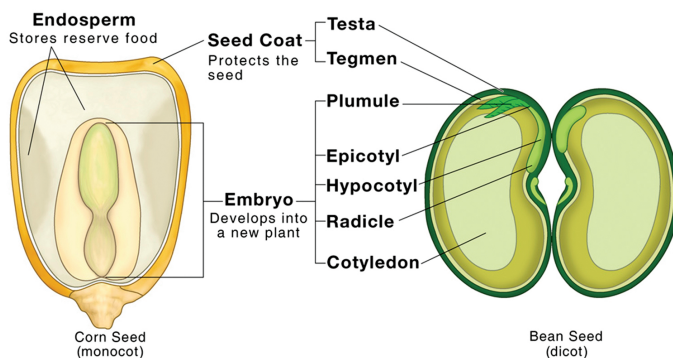


Figure 17. Structure of seeds of dicotyledonous (a) and monocotyledonous (b) plants [37]

The embryo is a miniature plant in an arrested state of development. Embryo consists of germinal root, germinal stem and cotyledons. Epicotyl – the tiny shoot of an embryo, from which the entire shoot system develops. The tip of the epicotyl is called plumule. Hypocotyl is the stage of transition for the growing shoot and root of the embryo. Radicle – the tiny root of the embryo. Cotyledons are the leaves of the embryo that provide nourishment to the developing plant [37].

The endosperm (and in some species the cotyledons) is a built-in food supply (stocking nutrients), which can be made up of proteins, carbohydrates or fats. The seed coat, a hard outer covering, protects the seed from disease and

insects. It also regulates water intake in the seed and initiating germination before the proper time.

A seed is primarily of two types. The two types are: monocotyledonous seed and dicotyledonous seed.

A monocotyledonous seed, as the name suggests, has only one cotyledon. Seed coat in the seed of cereals such as maize, wheat and oats is membranous and generally fused with the fruit wall, called hull (Figure 18). The endosperm is a tissue that stores nutrients necessary for the development of the embryo during germination. Generally, monocotyledonous seeds are endospermic (albuminous seed) but some as in orchids are non-endospermic (exalbuminous seed). Aleurone layer is the outer covering of endosperm that separates the embryo from a proteinous layer.

The embryo is small and situated in a groove at one end of the endosperm. The embryo consists of a shield, germinal root, germinal stem. Scutellum is one large and shield-shaped cotyledon. Plumule and radicle are the two ends of embryonal axis. The plumule and radicle are enclosed in sheaths which are called coleoptile and coleorhiza [61].

Unlike monocotyledonous seed, a dicotyledonous seed, as the name suggests, has two cotyledons. The seed coat of the seed has two layers, the outer testa and the inner tegmen. The seed has the hilum, it is a scar on the seed coat through which the developing seed was attached to the fruit. Micropyle is a small pore in the seed coat through which oxygen and water flow in the future germination of the seed.

Embryo consists of germinal root, germinal stem, two cotyledons (first germinal leaves), germinal bud. Cotyledons are often fleshy and full of reserve food materials. In many dicots, the food reserves of the endosperm are completely exported to the cotyledons before the seed completes its development, and consequently the mature seed lacks endosperm. In plants such as bean, gram and pea, the endosperm is not present in the matured seed. They are known as non-endospermous (exalbuminous seed) [12,61].

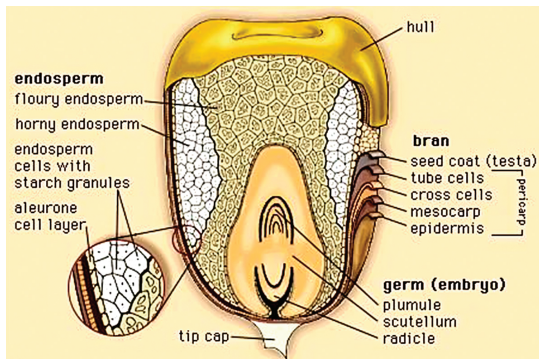


Figure 18. Structure of monocotyledonous [39]

## II. Match the following word – combinations.

|                       |                                         |
|-----------------------|-----------------------------------------|
| a) embryo             | 1) насіннєва шкірка, оболонка насінини, |
| b) endosperm          | 2) вуглеводи                            |
| c) seed coat          | 3) ембріон, зародок                     |
| d) proteins           | 4) сім'ядолі                            |
| e) carbohydrates      | 5) запасуючі поживні речовини           |
| f) cotyledons         | 6) ендосперм                            |
| g) stocking nutrients | 7) білки                                |

## III. Learn the following words and word – combinations.

|                  |                                              |
|------------------|----------------------------------------------|
| proteinous layer | білковий шар                                 |
| germinal root    | зародковий корінець                          |
| germinal stem    | зародковий стебелець                         |
| germinal bud     | зародкова брунька                            |
| shield-shaped    | щитоподібний                                 |
| plumule          | зародковий або первинний пагін               |
| embryonal axis   | ембріональна вісь                            |
| coleorhiza       | колеориза, коренева піхва                    |
| coleoptile       | колеоптиль, колеоптиль                       |
| outer testa      | зовнішня насіннєва оболонка                  |
| inner tegmen     | внутрішня насіннєва оболонка                 |
| epicotyl         | епікотиль, надсім'ядольне коліно             |
| hypocotyl        | гіпокотиль, підсім'ядольне коліно            |
| scutellum        | щиток ( <i>зерно злакових</i> )              |
| aleurone layer   | алейроновий шар ( <i>зерно</i> )             |
| plumule          | перша брунька зародка з зародковими листками |

## IV. Show general understanding of the text answering the questions.

1. What is a seed?
2. What information does a seed contain?
3. What does a seed consist of?
4. What does an embryo consist of?
5. What is the function of the seed coat?
6. What are the types of seeds?
7. What seed has two cotyledons?

## V. Agree or disagree with the following statements.

1. Cotyledons are the leaves of the embryo that provide nourishment to the developing plant.
2. The tip of the hypocotyl is called plumule.
3. The endosperm regulates water intake in the seed.

4. Nutrients necessary for the development of the embryo during germination are stored in the endosperm.
5. The embryo in a monocotyledonous seed is situated in a groove at one end of the endosperm.
6. The embryo in a monocotyledonous seed consists of two cotyledons.
7. The developing seed attaches to the fruit through the hilum.
8. Oxygen and water flow in the seed through cotyledons.

#### **VI. Fill in the blanks with the correct words and phrases from the word bank**

**Word bank - carbohydrates, outer testa, food materials, proteinous, embryonal, seed coat, development**

1. The embryo is a miniature plant in an arrested state of ....
2. The endosperm contains proteins .... or fats.
3. In the seed of cereals the .... is membranous.
4. Aleuron layer separates the embryo from a ... layer.
5. Plumule and radicle are the two ends of .... axis.
6. The seed coat of a dicotyledonous seed has two layers, the .... and the inner tegmen.
7. Cotyledons are often fleshy and full of reserve ....

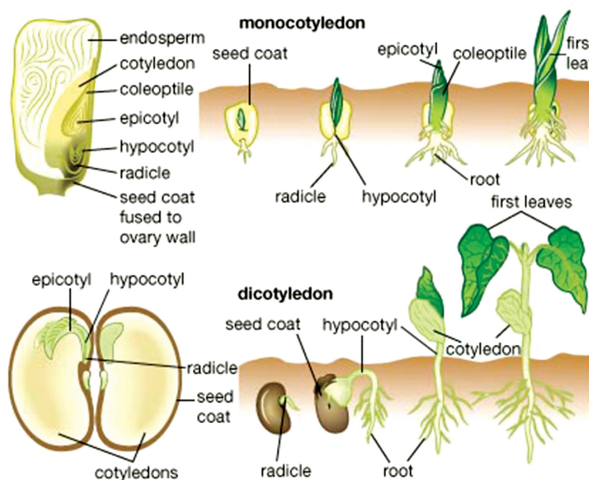
### **Text 19 Germination**

#### **I. Read and translate the text.**

Germination is when a seed embryo goes from a dormant state to an active, growing state. Before any visual signs of germination appear, the seed must absorb water through its seed coat. It also must have enough oxygen and a favorable temperature. Some species, such as celery, also require light. Others require darkness. If these requirements are met, the radicle is the first part of the seedling to emerge from the seed. It develops into the primary root and grows downward. From this primary root, root hairs and lateral roots develop. Between the radicle and the first leaflike structure is the hypocotyl, which grows upward in response to light.

The seed leaves, or cotyledons, encase the embryo. They usually are shaped differently than the leaves the mature plant will produce. Monocots produce one cotyledon, while dicots produce two [34].

Many factors affect the germination. The seed's age greatly affects its viability (ability to germinate). Older seed generally is less viable than young seed, and if it does germinate, the seedlings are less vigorous and grow more slowly.



**Figure 19. Internal structures of a corn seed with stages of germination (top); Internal structures of a bean seed with stages of germination (bottom) [21]**

The seedbed must be properly prepared and made up of loose, fine-textured soil. Seeds must be planted at the proper depth. If they are too shallow, they may wash away with rain or watering; if too deep, they won't be able to push through the soil. Seeds must have a continual supply of moisture; however, if over-watered, they will rot.

Many weed seeds are able to germinate quickly and under less than optimal conditions. This is one reason they make such formidable opponents in the garden [34].

In monocotyledon nutrients are stored in the cotyledon and endosperm tissue (Figure 19). The radicle and hypocotyl (region between the cotyledon and radicle) give rise to the roots. The epicotyl (region above the cotyledon) gives rise to the stem and leaves and is covered by a protective sheath (coleoptile). In dicotyledon all nutrients are stored in the enlarged cotyledons. The radicle gives rise to the roots, the hypocotyl to the lower stem, and the epicotyl to the leaves and upper stem [21].

## **II. Match the following word – combinations.**

|                      |                     |
|----------------------|---------------------|
| a) dormant state     | 1) бічний корінь    |
| b) primary root      | 2) міцний саджанець |
| c) root hairs        | 3) зріла рослина    |
| d) lateral root      | 4) насіннєве ложе   |
| e) mature plant      | 5) стан спокою      |
| f) vigorous seedling | 6) первинний корінь |
| h) seedbed           | 7) кореневі волоски |

### **III. Show general understanding of the text answering the questions.**

1. What are the obligatory requirements for germination?
2. What is the first part of the seedling to emerge from the seed?
3. How does the hypocotyl grow?
4. How many cotyledons do dicots and monocots produce?
5. How does the seed's age affect the germination?
6. How does the depth of planting influence the seed?

### **IV. Agree or disagree with the following statements.**

1. Before germinating, the seed must absorb water through its seed coat.
2. The radicle develops into the primary root and grows upward.
3. Cotyledons are the seed leaves.
4. Cotyledons usually are shaped differently than the leaves of the mature plant.
5. Older seed generally is more viable than young seed.
6. Many weed seeds are able to germinate under less than optimal conditions.

### **V. Fill in the blanks with the correct words and phrases from the word bank**

**Word bank – oxygen, viability, seedbed, primary root, moisture, embryo.**

1. Germination is when a seed .... goes from a dormant state to an active, growing state.
2. The seed must have enough .... and a favorable temperature.
3. From the ...., root hairs and lateral roots develop.
4. The seed's age greatly affects its .... (ability to germinate).
5. The .... must be made up of loose, fine-textured soil.
6. Seeds must have a continual supply of ....

### **VI. Match the words (1- 3) with the definitions (A-C).**

- 1 – seedling
  - 2 – germinate
  - 3 – seed vigor
- A) .... is how likely a seed is to grow and how strong its seedling will be.
  - B) A .... is a baby plant that comes from a seed.
  - C) To .... is for a seed to begin to grow.

## **PART III**

# **ENVIRONMENTAL FACTORS AFFECTING PLANT GROWTH**

### **Text 20**

#### **Environmental Factors Affecting Plant Growth**

##### **I. Read and translate the text.**

Environmental factors that affect plant growth include light, temperature, water, humidity, and nutrition. With a basic understanding of these factors, you may be able to manipulate plants to meet your needs, whether for increased leaf, flower, or fruit production. By recognizing the roles of these factors, you also will be better able to diagnose plant problems caused by environmental stress.

Temperature influences most plant processes, including photosynthesis, transpiration, respiration, germination, and flowering. As temperature increases (up to a point), photosynthesis, transpiration, and respiration increase. When combined with day-length, temperature also affects the change from vegetative (leafy) to reproductive (flowering) growth. Depending on the situation and the specific plant, the effect of temperature can either speed up or slow down this transition [16].

Water is very important for plants because it acts as a media for chemical reaction within cells, basic component to form nutrition, and facilitator to help circulating nutrition throughout plant's body. Plants which lack of water wither by which their green color changes into yellow and dries. And finally die.

Plants require oxygen to break down nutrient they produce into simple substances and energy. The process to break down nutrient by using oxygen is called cellular respiration. Then, plants will use the energy they produce to do their activities, one of which is growth. If oxygen supply is insufficient, then the process of growth and development will be disturbed [55].

Just like water, carbon dioxide is required in the process of nutrient manufacture through photosynthesis process. The lack of carbon dioxide can also decrease nutrient manufactured.

Light is required by plant to conduct photosynthesis. Plant that grows in enough light condition will produce strong stem, more developed leaves and green color. On some plant species the length of light period has strong influence on plant growth and development. Plant's respond to the length of the periods of light is called photoperiodism.

Plants require various nutrients in soil. They are used as components to make organic matter in cell. Nutrient in soil can be classified into macronutrient and micronutrient. Macronutrients are required in large amount, while micronutrients are required in smaller amount [55].

## II. Match the following word – combinations.

|                           |                                  |
|---------------------------|----------------------------------|
| a) lack of water          | 1) розщеплювати поживні речовини |
| b) affect plant growth    | 2) проводити фотосинтез          |
| c) meet needs             | 3) впливати на ріст рослин       |
| d) conduct photosynthesis | 4) прискорювати                  |
| e) break down nutrients   | 5) викликати проблему            |
| f) cause problem          | 6) задовольняти потреби          |
| g) speed up               | 7) гальмувати                    |
| h) slow down              | 8) нестача води                  |

## III. Show general understanding of the text answering the questions.

1. What factors affect plant growth?
2. What processes does temperature influence?
3. What factor acts as a media for chemical reaction within cells?
4. Why do plants require oxygen?
5. Why is carbon dioxide important?
6. What factor conducts photosynthesis?
7. What is photoperiodism?
8. What factors make organic matter in cell?

## IV. Agree or disagree with the following statements.

1. You can better diagnose plant problems caused by environmental stress recognizing the roles of environmental factors.
2. As temperature increases (up to a point), photosynthesis, transpiration, and respiration decrease.
3. Water acts as facilitator to help circulating nutrition throughout plant's body.
4. When plants which lack of water wither their color changes.
5. Plants break down nutrient into simple substances and energy without using oxygen.
6. Lack of oxygen leads to the disturbance of growth.
7. Sufficient light condition promotes strong stem and more developed leaves.
8. Usually micronutrients are required in large amount.

**V. Fill in the blanks with the correct words and phrases from the word bank**

**Wordbank - cellular respiration, plant, transpiration, organic matter, nutrient manufacture, water, slow down.**

1. As temperature increases photosynthesis and .... increase.
2. The effect of temperature can either speed up or .... the change from vegetative (leafy) to reproductive (flowering) growth.
3. Plants which lack of ....wither.
4. The process to break down nutrient by using oxygen is called ....
5. Carbon dioxide is required in the process of ....through photosynthesis process.
6. Light is required by .... to conduct photosynthesis.
7. Various nutrients in soil are used by plants as components to make .... in cell.

## **Text 21**

### **Temperature**

#### **I. Read and translate the text.**

Temperature is one of the important environmental factors that affects major plant processes and is species dependent. Cool-season plants (cold-resistant plants) such as spinach, radish and salad germinate best at 55° to 65°F, while warm-season crops (thermophilic crops) such as tomato, petunia, and lobelia germinate best at 65° to 75°F. Different species require different temperatures during growth, flowering and fruiting [16].

When combined with day-length, temperature affects the change from vegetative (leafy) to reproductive (flowering) growth. Depending on the situation and the specific plant, the effect of temperature can either speed up or slow down this transition. Sometimes horticulturists use temperature in combination with day length to manipulate flowering [16]. Temperature also affects the quality of the crops. Low temperatures reduce energy use and increase sugar storage. Thus, leaving crops such as ripe winter squash on the vine during cool, fall nights increases their sweetness.

Adverse temperatures, however, cause stunted growth and poor-quality vegetables. Temperatures higher than needed increase respiration, sometimes above the rate of photosynthesis. Thus, photosynthates are used faster than they are produced. For growth to occur, photosynthesis must be greater than respiration. Daytime temperatures that are too low often produce poor growth by slowing down photosynthesis. The result is reduced yield. Daytime

temperatures that are too high sometimes lead to the poor quality vegetables. For example, high temperatures cause bitter lettuce [16].

Thermoperiod refers to daily temperature change. Plants grow best when daytime temperature is about 10 to 15 degrees higher than nighttime temperature. Under these conditions, plants photosynthesize (build up) and respire (break down) during optimum daytime temperatures and then curtail respiration at night.

Some plants that grow in cold regions need a certain number of days of low temperature (dormancy). Knowing the period of low temperature required by a plant, if any, is essential in getting it to grow to its potential. Peaches are a prime example; most varieties require 700 to 1,000 hours between 32° and 45°F before breaking their rest period and beginning growth. Lilies need 6 weeks of temperatures at or slightly below 33°F before blooming [16].

## **II. Match the following word – combinations.**

|                        |                            |
|------------------------|----------------------------|
| a) species dependent   | 1) репродуктивне зростання |
| b) vegetative growth   | 2) сповільнювати           |
| c) reproductive growth | 3) залежний від видів      |
| d) sugar storage       | 4) вегетативне зростання   |
| e) winter squash       | 5) вміст цукру             |
| f) slow down           | 6) озимі гарбузові         |

## **III. Show general understanding of the text answering the questions.**

1. What is the best temperature to germinate for cool and warm season plants?
2. How do horticulturists manipulate flowering?
3. How does low temperatures affect the quality of the crops?
4. What do too low and too high daytime temperatures lead to?
5. What is a thermoperiod?
6. When do plants grow best?

## **IV. Agree or disagree with the following statements.**

1. Temperature is species dependent.
2. Temperature affects the change from vegetative to reproductive growth.
3. Temperatures higher than needed decrease respiration.
4. For growth to occur, respiration must be greater than photosynthesis.
5. Some plants that grow in cold regions need dormancy.
6. Low temperatures cause bitter lettuce.

**V. Fill in the blanks with the correct words and phrases from the word bank.**

**Word bank - quality, environmental, sugar, blooming, stunted growth, temperatures.**

1. Temperature is one of the important .... factors.
2. Different species require different .... during growth, flowering and fruiting.
3. Temperature also affects the .... of the crops.
4. Adverse temperatures cause .... and poor-quality vegetables.
5. Low temperatures can increase .... storage.
6. Lilies need 6 weeks of temperatures at or slightly below 33°F before.....

## **Text 22**

### **Light in plant life**

#### **I. Read and translate the text.**

Three principal characteristics of light affect plant growth: quantity, quality, and duration. Light quantity refers to the intensity, or concentration of sunlight. It varies with the seasons. The maximum amount of light is present in summer, and the minimum in winter. Up to a point, the more sunlight a plant receives, the greater its capacity for producing food via photosynthesis [16].

You can manipulate light quantity to achieve different plant growth patterns. Increase light by surrounding plants with reflective materials, a white background, or supplemental lights. Decrease it by shading plants with cheesecloth or woven shade cloths.

Light quality refers to the color (wavelength) of light. Sunlight supplies the complete range of wavelengths and can be broken up by a prism into bands of red, orange, yellow, green, blue, indigo and violet.

Blue and red light, which plants absorb, have the greatest effect on plant growth. Blue light is responsible primarily for vegetative (leaf) growth. Red light, when combined with blue light, encourages flowering. Plants look green to us because they reflect, rather than absorb, green light.

Duration, or photoperiod, refers to the amount of time a plant is exposed to light. Photoperiod controls flowering in many plants. Scientists initially thought the length of light period triggered flowering and other responses within plants. Thus, they describe plants as short-day or long-day, depending on what conditions they flower under. We now know that it is not the length of the light period, but rather the length of uninterrupted darkness, that is critical to floral development [16].

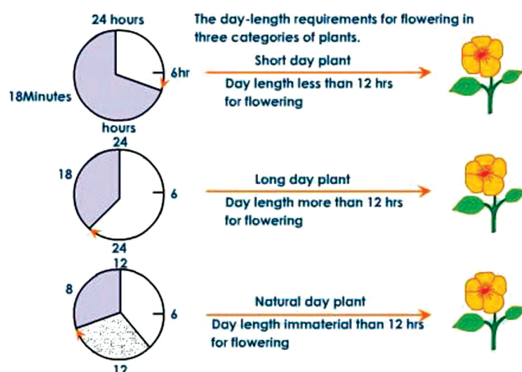


Figure 20. Classification of plants based on photoperiodism [8]

Plants are classified into three categories: short-day (long-night), long-day (short-night), or day-neutral, depending on their response to the duration of light or darkness (Figure 20). Short-day plants form flowers only when day length is less than about 12 hours. In contrast, long-day plants form

flowers only when day length exceeds 12 hours. Day-neutral plants form flowers regardless of day length. Examples are tomato, corn, cucumber, and some strawberry cultivars.

Some plants do not fit into any category, but may respond to combinations of day lengths. Petunias, for example, flower regardless of day length, but flower earlier and more profusely with long days [16].

## II. Match the following word – combinations.

|                         |                        |
|-------------------------|------------------------|
| a) light quantity       | 1) розвиток квітів     |
| b) plant growth pattern | 2) викликати цвітіння  |
| c) supplemental lights  | 3) рясно квітнути      |
| d) trigger flowering    | 4) модель росту рослин |
| e) floral development   | 5) додаткові вогні     |
| f) duration of darkness | 6) кількість світла    |
| g) flower profusely     | 7) тривалість темряви  |

## III. Show general understanding of the text answering the questions.

1. What are principal characteristics of light?
2. What does the plant's capacity for producing food via photosynthesis depend on?
3. How can you increase light for better plant growth?
4. What colours have the greatest effect on plant growth?
5. What colours encourage flowering?
6. What is a photoperiod?
7. What is critical to floral development: the length of the light period or the length of uninterrupted darkness?

#### **IV. Agree or disagree with the following statements.**

1. Light quantity refers to the color (wavelength) of light.
2. The maximum amount of light is present in winter, and the minimum in summer.
3. You can not manipulate light quantity to achieve different plant growth patterns.
4. We can decrease light by shading plants with cheesecloth or woven shade cloths.
5. Sunlight can be broken up by a prism into bands of red, orange, yellow.
6. Blue and green light, which plants absorb, have the greatest effect on plant growth.
7. Photoperiod controls flowering in many plants.
8. Long-day plants form flowers regardless of day length.

#### **V. Fill in the blanks with the correct words and phrases from the word bank.**

**Word bank - light period, long days, vegetative growth, duration of light, day length, light quantity, absorb, wavelength.**

1. You can manipulate .... to achieve different plant growth patterns.
2. Light quality refers to the color (....) of light.
3. Blue light is responsible primarily for .....
4. Plants look green to us because they reflect, rather than ....., green light.
5. It is not the length of the .... that is critical to floral development.
6. Plants are classified into three categories, depending on their response to the .... or darkness.
7. Day-neutral plants form flowers regardless of ....
8. Petunias flower earlier and more profusely with ....

### **Text 23**

#### **Water and humidity**

##### **I. Read and translate the text.**

Most growing plants contain about 90 percent water. Water plays many roles in plants. It is: 1) a primary component in photosynthesis and respiration; 2) responsible for turgor pressure in cells (Like air in an inflated balloon, water is responsible for the fullness and firmness of plant tissue. Turgor is needed to maintain cell shape and ensure cell growth.); 3) a solvent for minerals and carbohydrates moving through the plant; 4) responsible for cooling leaves as it

evaporates from leaf tissue during transpiration; 5) a regulator of stomatal opening and closing, thus controlling transpiration and, to some degree, photosynthesis; 6) the source of pressure to move roots through the soil; 7) the medium in which most biochemical reactions take place.

Relative humidity is the ratio of water vapor in the air to the amount of water the air could hold at the current temperature and pressure. Warm air can hold more water vapor than cold air. Relative humidity (RH) is expressed by the following equation:  $RH = \text{water in air} \div \text{water air could hold (at constant temperature and pressure)} \times 100\%$ .

For example, if a pound of air at 75°F could hold 4 grams of water vapor, and there are only 3 grams of water in the air, then the relative humidity (RH) is:  $3 \div 4 \times 100\% = 75\%$ .

Water vapor moves from an area of high relative humidity to one of low relative humidity. The greater the difference in humidity, the faster water moves. This factor is important because the rate of water movement directly affects a plant's transpiration rate.

The relative humidity in the air spaces between leaf cells approaches 100 percent. When a stoma opens, water vapor inside the leaf rushes out into the surrounding air and a bubble of high humidity is formed around the stoma. By saturating this small area of air, the bubble reduces the difference in relative humidity between the air spaces within the leaf and the air adjacent to the leaf. As a result, transpiration slows down. If wind blows the humidity bubble away, however, transpiration increases.

Thus, transpiration usually is at its peak on hot, dry, windy days. On the other hand, transpiration generally is quite slow when temperatures are cool, humidity is high, and there is no wind.

Hot, dry conditions generally occur during the summer, which partially explains why plants wilt quickly in the summer. If a constant supply of water is not available to be absorbed by the roots and moved to the leaves, turgor pressure is lost and leaves go limp [ 16].

## II. Match the following word – combinations.

|                        |                           |
|------------------------|---------------------------|
| a) turgor pressure     | 1) підтримка форми клітин |
| b) maintain cell shape | 2) водяна пара            |
| c) relative humidity   | 3) тиск тургору           |
| d) water vapor         | 4) джерело тиску          |
| e) transpiration rate  | 5) відносна вологість     |
| f) constant supply     | 6) закриття продихів      |
| g) stomatal closing    | 7) швидкість транспірації |
| h) source of pressure  | 8) постійний запас        |

### **III. Show general understanding of the text answering the questions.**

1. What is relative humidity?
2. How does water vapor moves?
3. What does the rate of water movement affect?
4. What is the percent of the relative humidity in the air spaces between leaf cells?
5. How is a bubble of high humidity formed around the stoma?
6. When is transpiration at its peak?
7. When is transpiration quite slow?
8. What weather conditions lead to the turgor pressure loss?

### **IV. Agree or disagree with the following statements.**

1. Most growing plants contain about 100 percent water.
2. Water is a primary component in photosynthesis and respiration.
3. Water cools leaves as it evaporates from leaf tissue during transpiration.
4. Water is the medium in which most biochemical reactions take place.
5. Cold air can hold more water vapor than warm air.
6. The greater the difference in humidity, the slower water moves.
7. The rate of water movement directly affects a plant's transpiration rate.
8. The relative humidity in the air spaces between leaf cells approaches 90 percent.

### **V. Fill in the blanks with the correct words and phrases from the word bank.**

**Word bank - carbohydrates, conditions, leaves, biochemical reactions, water vapour, source of pressure, turgor.**

1. Water is responsible for.... pressure in cells.
2. Water is a solvent for minerals and .... moving through the plant.
3. Water is the .... to move roots through the soil.
4. Water is the medium in which most .... take place.
5. When a stoma opens, .... inside the leaf rushes out into the surrounding air.
6. Hot, dry .... generally occur during the summer.
7. If a constant supply of water is not available .... go limp.

## **Text 24**

### **Plant nutrition**

#### **I. Read and translate the text.**

Plants, unlike animals, do not have to obtain organic materials for their nutrition, although these form the bulk of their tissues. By trapping solar energy in photosynthetic systems, they are able to synthesize nutrients from carbon dioxide (CO<sub>2</sub>) and water [40].

There is a large number of elements in nature, out of which sixteen are important for the proper growth and development of crop plants: Carbon, Hydrogen, Oxygen, Nitrogen, Phosphorus, Potash, Calcium, Magnesium, Sulfur, Iron, Copper, Zinc, Boron, Molybdenum, Manganese and Chloride. C, H and O contribute the 85-90 % of the total plant content. They are organic elements [25].

However, plants do require inorganic salts, which they absorb from the soil surrounding their roots. Soil is a major source of nutrients needed by plants for growth [40].

The three main nutrients are nitrogen (N), phosphorus (P) and potassium (K). Together they make up the trio known as NPK. Plants require nitrogen in the form of nitrate (NO<sub>3</sub><sup>-</sup>) or ammonium (NH<sub>4</sub><sup>+</sup>) ions; phosphorus in the form of phosphate and, potassium in the form of cation (K<sup>+</sup>). These are called macro or major nutrients and required in comparatively large amounts [40,25].

N gives dark-green colour to crop plants and it increases the vegetative growth of crop plants. It is most important for preparation of starch in leaves and production of amino acids. P is the constituent of certain nucleic acids, phosphatides, chromosomes and enzymes. P works as a catalyst in about 60 enzymatic systems of the plants and regulates the water in plants and reduces the negative effects of salts in the plants [25].

Potassium is associated with the movement of water, nutrients and carbohydrates in plant tissue. It's involved with enzyme activation within the plant, which affects protein, starch and adenosine triphosphate (ATP) production. The production of ATP can regulate the rate of photosynthesis. Potassium also helps regulate the opening and closing of the stomata, which regulates the exchange of water vapor, oxygen and carbon dioxide. If K is deficient or not supplied in adequate amounts, it stunts plant growth and reduces yield. For perennial crops such as alfalfa, potassium plays a role in stand persistence through the winter [66]. Other important nutrients are: calcium (Ca), magnesium (Mg) and sulfur (S). They are mesoelements. Ca is an

important constituent of plant cell wall and it promotes early root growth and development [25,40].

Magnesium is the central core of the chlorophyll molecule in plant tissue. Thus, if Mg is deficient, the shortage of chlorophyll results in poor and stunted plant growth. Magnesium also helps to activate specific enzyme systems [65].

In plants, sulfur is essential for nitrogen-fixing nodules on legumes, and necessary in the formation of chlorophyll. Plants use sulfur in the processes of producing proteins, amino acids, enzymes and vitamins. Sulfur also helps the plant's resistance to disease, aids in growth, and in seed formation [10].

Iron (Fe), boron (B), manganese (Mn), zinc (Zn), copper (Cu), molybdenum (Mo), cobalt (Co), silicon (Si) are the micro or minor nutrients which are required in smaller quantities for vegetative and reproductive growth of crop plants but play a very important role in the physiological processes of the crop plants [25,40].

Testing the soil helps determine what nutrients are available or unavailable for growing certain crops. The best soil has a balance of nutrients, such as nitrogen, phosphorus, potassium and others.

## II. Learn the following verbs.

|              |                            |
|--------------|----------------------------|
| to obtain    | отримувати                 |
| to trap      | ловити                     |
| to require   | вимагати, потребувати      |
| to surround  | оточувати                  |
| to determine | визначати                  |
| to proceed   | продовжувати, відновлювати |
| to result    | випливати                  |
| to involve   | залучати, містити в собі   |

## III. Match the following words and word - combinations.

|                      |                                   |
|----------------------|-----------------------------------|
| a) nutrition         | 1) тканина                        |
| b) bulk              | 2) зростання                      |
| c) tissue            | 3) корінь                         |
| d) solar             | 4) живлення                       |
| e) carbon dioxide    | 5) джерело                        |
| f) shoot system      | 6) сонячний                       |
| g) root              | 7) витривалість врожаю            |
| h) source            | 8) маса                           |
| i) growth            | 9) вегетативна система            |
| g) crop              | 10) вуглекислий газ               |
| k) stand persistence | 11) сільськогосподарська культура |

#### **IV. Show general understanding of the text answering the questions.**

1. How do plants synthesize nutrients?
2. How do plants obtain inorganic salts?
3. What are the three main nutrients?
4. Why is nitrogen so important for plants?
5. What nutrient regulates the water in plants?
6. What nutrient is important for production of amino acids?
7. What nutrient is important for production of adenosine triphosphate?
8. How does the deficiency of magnesium affect the plant growth?
9. When do plants use sulfur?
10. What elements belong to the micro nutrients?

#### **V. Agree or disagree with the following statements.**

1. Plants, like animals, have to obtain organic materials for their nutrition.
2. The major source of nutrients is soil.
3. The trio known as NPK is not required in large quantities.
4. Phosphorus regulates the water in plants.
5. The production of ATP in the plant can regulate the rate of photosynthesis.
6. The deficiency of potassium leads to the yield reducing.
7. Calcium, magnesium and sulfur are microelements.
8. Calcium is the constituent of plant cell wall.
9. Magnesium is essential for nitrogen-fixing nodules on legumes.
10. The best soil has a balance of nutrients.

#### **VI. Fill in the blanks with the correct words and phrases from the word bank.**

**Word bank – salts, phosphorus, resistance, elements, nitrogen, root, physiological processes, NPK, nutrients, synthesize.**

1. Plants, unlike animals, are able to .... nutrients from carbon dioxide and water.
2. Sixteen .... are important for proper growth and development of crop plants.
3. Soil is a major source of .... needed by plants for growth.
4. The trio known as .... is required in comparatively large amounts.
5. .... is the constituent certain nucleic acids.
6. .... gives dark-green color to crop plants.
7. Phosphorus reduces the negative effect of .... in plants.
8. Calcium promotes early .... growth and development.
9. Micro nutrients play a very important role in the .... of the crop plants.

10. Sulfur helps the plant's .... to disease.

**VII. Match the words (1- 5) with the definitions (A-E).**

1 - legume

2 - stunted

3 - carbohydrate

4 - protein

5 - nutrition

A) .... is the process of nourishing an organism.

B) A .... is a substance food that the body uses to make energy.

C) If a plant is ....., it is not growing as large as it should.

D) A .... is an edible plant that has pods.

E) .... is a chemical in plant or animal material that helps the body grow.

**PART IV.**  
**TECHNOLOGIES IN AGRONOMY**

**Text 25**  
**Organic farming**

**I. Read and translate the text.**

Organic farming is a method of crop and livestock production that involves much more than choosing not to use pesticides, fertilizers, genetically modified organisms, antibiotics and growth hormones. Organic production is a holistic system designed to optimize the productivity and fitness of diverse communities within the agro-ecosystem, including soil organisms, plants, livestock and people. The principal goal of organic production is to develop enterprises that are sustainable and harmonious with the environment [35].

The general principles of organic production include the following:

1) protect the environment, minimize soil degradation and erosion, decrease pollution, optimize biological productivity and promote a sound state of health; 2) maintain long-term soil fertility by optimizing conditions for biological activity within the soil; 3) maintain biological diversity within the system; 4) recycle materials and resources to the greatest extent possible within the enterprise; 5) prepare organic products, emphasizing careful processing, and handling methods in order to maintain the organic integrity and vital qualities of the products at all stages of production [35].

Organic farming promotes the use of crop rotations and cover crops. Preventative insect and disease control methods are practiced, including crop rotation, improved genetics and resistant varieties.

Integrated pest and weed management, and soil conservation systems are valuable tools on an organic farm. Organically approved pesticides include «natural» or other pest management products included in the Permitted Substances List (PSL) of the organic standards.

The organic standards generally prohibit products of genetic engineering and animal cloning, synthetic pesticides, synthetic fertilizers, sewage sludge, synthetic drugs, synthetic food processing aids and ingredients, and ionizing radiation. Prohibited products and practices must not be used on certified organic farms for at least three years prior to harvest of the certified organic products. Livestock must be raised organically and fed 100 per cent organic feed ingredients [35].

Compared with conventional agriculture, organic farming uses fewer pesticides, reduces soil erosion, decreases nitrate leaching into groundwater and surface water, and recycles animal wastes back into the farm.

These benefits are counterbalanced by higher food costs for consumers and generally lower yields. Indeed, yields of organic crops have been found to be about 25 percent lower overall than conventionally grown crops, although this can vary considerably depending upon the type of crop. The challenge for future organic agriculture will be to maintain its environmental benefits, increase yields, and reduce prices while meeting the challenges of climate change and an increasing world population [35].

## **II. Learn the following word – combinations.**

|                                 |                                    |
|---------------------------------|------------------------------------|
| synthetic food processing aids  | синтетичні засоби харчової обробки |
| holistic system                 | цілісна система                    |
| sound state of health           | міцне здоров'я                     |
| greatest extent possible        | максимально можлива міра           |
| careful processing              | ретельна обробка                   |
| organic integrity               | органічна цілісність               |
| vital qualities                 | життєві якості                     |
| crop rotation                   | сівозмінна                         |
| cover crops                     | покривні культури                  |
| resistant varieties             | стійкі сорти                       |
| soil conservation system        | система захисту ґрунтів            |
| organically approved pesticides | органічно затверджені пестициди    |
| Permitted Substances List (PSL) | список дозволених речовин          |
| integrated management           | комплексне управління              |
| sewage sludge                   | шлам стічних вод                   |

### III. Match the following word – combinations.

|                |                                 |
|----------------|---------------------------------|
| a) livestock   | 1) добрива                      |
| b) enterprise  | 2) забруднення                  |
| c) environment | 3) переробка                    |
| d) pollution   | 4) відходи                      |
| e) diversity   | 5) хімікати                     |
| f) processing  | 6) сільськогосподарські тварини |
| g) wastes      | 7) навколишнє середовище        |
| h) fertilizers | 8) підприємство                 |
| i) chemicals   | 9) різноманітність              |

### IV. Show general understanding of the text answering the questions.

1. What is the principal goal of organic production?
2. What methods of disease control are practiced in organic farming?
3. What are valuable tools on an organic farm?
4. What products are prohibited by the organic standards?
5. How is livestock fed on the organic farms?
6. What advantages has organic farming compared with conventional agriculture?
7. What are the disadvantages of the organic farming?
8. What are the reasons for some farmers to farm organically?

### V. Agree or disagree with the following statements.

1. Organic farming is a method of crop and livestock production that involves using pesticides, fertilizers, genetically modified organisms.
2. Organic production is a system that optimizes the productivity and fitness of diverse communities within the agro-ecosystem.
3. Protection of the environment and pollution decrease is one of the general principles of organic production.
4. The Permitted Substances List (PSL) of the organic standards prohibits products of genetic engineering but allows synthetic food processing aids and ingredients.
5. Yields of organic crops are often about 25 percent lower overall than conventionally grown crops.
6. A lot of farmers prefer organic farming because they don't want to work with agricultural chemicals.
7. Insect and disease control methods include crop rotation, improved genetics and resistant varieties.

**VI. Fill in the blanks with the correct words and phrases from the word bank.**

**Word bank—crop rotations, profitable, groundwater, climate change, livestock, biological diversity, enterprise.**

1. One of the aims of organic production is to maintain .... within the system.
2. Organic production implies recycling materials within the.....
3. Organic farming promotes the use of .... and cover crops.
4. .... must be raised organically and fed 100 per cent organic feed ingredients.
5. Organic farming decreases nitrate leaching into .... and surface water.
6. The challenge for future organic agriculture will be to reduce prices while meeting the challenges of .... and an increasing world population.
7. Organic farmers find their method of farming to be .... and personally rewarding.

**Text 26**

**What is hydroponics?**

**I. Read and translate the text.**

Hydroponics, by definition, is a method of growing plants in a water based, nutrient rich solution. Hydroponics does not use soil, instead the root system is supported using an inert medium such as perlite, rockwool, clay pellets, peat moss, or vermiculite. The basic premise behind hydroponics is to allow the plants roots to come in direct contact with the nutrient solution, while also having access to oxygen, which is essential for proper growth.

Growing with hydroponics comes with many advantages, the biggest of which is a greatly increased rate of growth in plants. With the proper setup, plants will mature up to 25% faster and produce up to 30% more than the same plants grown in soil. Plants will grow bigger and faster because they will not have to work as hard to obtain nutrients. Even a small root system will provide the plant exactly what it needs, so the plant will focus more on growing upstairs instead of expanding the root system downstairs.

All of this is possible through careful control of nutrient solution and pH levels. A hydroponics system will also use less water than soil based plants because the system is enclosed, which results in less evaporation. Hydroponics is better for the environment because it reduces waste and pollution from soil runoff.

Despite the fact that a hydroponics system has so many advantages, there are actually a few disadvantages as well. The biggest factor for most people is that a quality hydroponics system of any size will cost more than its soil counterpart. Plus, managing the hydroponics system will take a lot of time as well. You will have to monitor and balance your pH and nutrient levels on a daily basis. The greatest risk with a hydroponics system is that something like a pump failure can kill off your plants within hours depending on the size of your system [24].

## II. Learn the following word – combinations.

|                          |                            |
|--------------------------|----------------------------|
| inert medium             | інертне середовище         |
| rockwool                 | кам'яна вата               |
| clay pellets             | глиняні гранули            |
| peat moss                | торф'яний мох              |
| basic premise            | основна передумова         |
| come in direct contact   | безпосередньо контактувати |
| increased rate of growth | збільшений темп росту      |
| soil based plants        | рослини на ґрунті          |
| soil runoff              | сток ґрунтів               |
| hydroponics system       | система гідропоніки        |
| nutrient level           | рівень поживних речовин    |

## III. Show general understanding of the text answering the questions.

1. What medium is used in hydroponics instead of soil?
2. What is the basic premise behind hydroponics?
3. What is the biggest advantage of hydroponics ?
4. Why does hydroponics system use less water than soil based plants?
5. What is a disadvantage of a hydroponics system?
6. Why is hydroponics better for the environment?
7. What is the greatest risk with a hydroponics system?

## IV. Agree or disagree with the following statements.

1. Hydroponics uses perlite, rockwool, clay pellets, peat moss or vermiculite instead of soil.
2. Having access to oxygen is essential for the plants roots.
3. With the proper setup, plants will mature up to 35% faster.
4. The enclosed system of hydroponics results in more evaporation.
5. Managing the hydroponics system will not take a lot of time.
6. Plants can be killed off within hours due to a pump failure.

**V. Fill in the blanks with the correct words and phrases from the word bank**

**Word bank - soil runoff , obtain nutrients, nutrient levels, root system, proper setup**

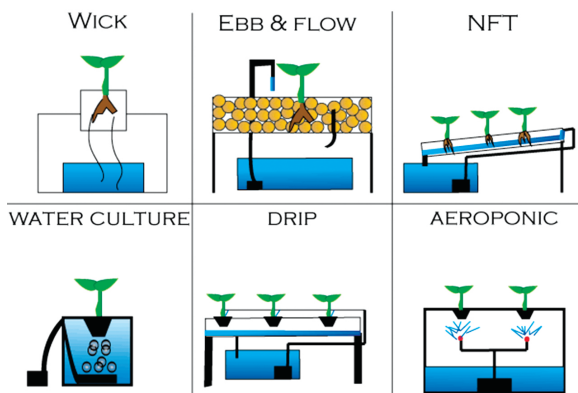
1. With the .... , plants will produce up to 30% more than the same plants grown in soil.
2. Plants will grow bigger and faster because they will not have to work as hard to .....
3. Even a small .... will provide the plant exactly what it needs.
4. Hydroponics reduces waste and pollution from .....
5. While managing the hydroponics system you will have to monitor and balance your pH and .... on a daily basis.

**Text 27**

**Types of Hydroponics Systems**

**I. Read and translate the text.**

Hydroponics is an excellent choice for all types of growers. A fine tuned hydroponics system can easily surpass a soil based system in plant quality and amount of produce yielded [24].



**Figure 21. Types of hydroponics systems [64]**

The cool thing about hydroponics is that there are many different types of hydroponics systems available. Some of the best hydroponics systems combine different types of hydroponics into one hybrid hydroponics system. Hydroponics is unique in that there are multiple

methods you can use to get the nutrient solution to plants: aggregoponics, chemoponics, aeroponics, ionitoponics, water culture.

There are 5 basic types of hydroponics systems; deep water culture system, (system of water borne platform) (DWC), the system of periodic flooding (Ebb and Flow), the system of nutrient layer (N.F.T.) (Nutrient Film

Technique) the system of drip irrigation (Drip) (recovery or non-recovery), capillary system (Wicksystem) (Wicking) (Figure 21).

Deepwater Culture (DWC), also known as the reservoir method, is by far the easiest method for growing plants with hydroponics. In a Deepwater Culture hydroponics system, the roots are suspended in a nutrient solution. An aquarium air pump oxygenates the nutrient solution, this keeps the roots of the plants from drowning.

The primary benefit to using a Deepwater Culture system is that there are no drip or spray emitters to clog. This makes DWC an excellent choice for organic hydroponics, as hydroponics systems that use organic nutrients are more prone to clogs.

An ebb and flow hydroponics system, also known as a flood and drain system functions by flooding the growing area with the nutrient solution at specific intervals. The nutrient solution then slowly drains back into the reservoir. The pump is hooked to a timer, so the process repeats itself at specific intervals so that plants get the desired amount of nutrients. This hydroponics system is ideal for plants that are accustomed to periods of dryness.

Nutrient Film Technique, or NFT, is a type of hydroponics system where a continuous flow of nutrient solution runs over the plants roots. This type of solution is on a slight tilt so that the nutrient solution will flow with the force of gravity. This type of system works very well because the roots of a plant absorb more oxygen from the air than from the nutrient solution itself.

A hydroponics drip system is rather simple. A drip system works by providing a slow feed of nutrient solution to the hydroponics medium. We recommend using a slow draining medium, such as coconut coir, or peat moss. The downside to a system like this is that the drippers / emitters are famous for clogging.

Wicking is one of the easiest and lowest costing systems of hydroponics. The nutrient solution is drawn into the growing medium from the reservoir with a wick. The concept behind wicking is that you have a material, such as cotton, that is surrounded by a growing medium with one end of the wick material placed in the nutrient solution. The solution is then wicked to the roots of the plant [24].

Wick systems work particularly well for small, home-grown plants, and this is a great choice for a home-based hydroponics system but it is not suitable for large plants that require more nutrients [68].

## II. Learn the following word – combinations.

|                                |                                                     |
|--------------------------------|-----------------------------------------------------|
| soil based system              | грунтова система                                    |
| multiple methods               | кілька прийомів                                     |
| deepwater culture              | культура ґлибоководних вод                          |
| drip emitter                   | крапельниця, розпилювач                             |
| ebb and flow system            | система відливу та стоку                            |
| nutrient film technique        | система живлячого шару                              |
| continous flow                 | безперервний потік                                  |
| force of gravity               | сила тяжіння                                        |
| slow feed of nutrient solution | повільне надходження живильного (поживного) розчину |

## III. Show general understanding of the text answering the questions.

1. Why is hydroponics unique?
2. What methods can you use to get the nutrient solution to plants?
3. What are the basic types of hydroponic system?
4. Which is the easiest method for growing plants with hydroponics?
5. What benefit of a Deepwater Culture system makes it excellent for organic hydroponics?
6. How does a flood and drain system function?
7. What plants is an Ebb and Flow hydroponics system ideal for?
8. What hydroponics system allows the roots of a plant absorb more oxygen from the air than from the nutrient solution itself?
9. What system provides a slow feed of nutrient solution to the hydroponics medium?

## IV. Agree or disagree with the following statements.

1. A fine tuned hydroponics system is much better than a soil based system.
2. In a Nutrient Film Technique the roots are suspended in a nutrient solution.
3. Hydroponics systems that use organic nutrients are more prone to clogs.
4. In an ebb and flow hydroponics system the growing area is flooded with the nutrient solution at specific intervals.
5. A hydroponics drip system is a type of hydroponics system where a continous flow of nutrient solution runs over the plants roots.
6. Wicking is one of the highest costing systems of hydroponics.
7. Wick system is not suitable for large plants that require more nutrients.

**V. Fill in the blanks with the correct words and phrases from the word bank.**

**Word bank – flood and drain, small, coconut coir, wicking, continous flow, reservoir, nutrient.**

1. Deepwater Culture (DWC), also known as the .... method.
2. In a Deepwater Culture hydroponics system, the roots are suspended in a .... solution.
3. An ebb and flow hydroponics system is known as a .... system.
4. In a Nutrient Film Technique a .... of nutrient solution runs over the plants roots on a slight tilt.
5. In a hydroponics drip system a slow draining medium, such as .... or peat moss is used.
6. .... is one of the easiest and lowest costing systems of hydroponics.
7. Wick systems work particularly well for ....., home-grown plants.

## **Text 28**

### **Wheat production in the world**

#### **I. Read and translate the text.**

The cultivation of wheat (*Triticum* spp.) reaches far back into history. Wheat was one of the first domesticated food crops and for 8 000 years has been the basic staple food of the major civilizations of Europe, West Asia and North Africa.

Although the crop is most successful between the latitudes of 30° and 60°N and 27° and 40°S, wheat can be grown beyond these limits, from within the Arctic Circle to higher elevations near the equator [9].

Wheat is grown yearly on 215 million hectares - an area equivalent to that of Greenland. Nearly US \$50 billion-worth of wheat is traded globally each year. First and foremost a food crop, wheat is eaten by 2.5 billion people in 89 countries. Wheat is the dominant staple in North Africa and West and Central Asia, providing as much as half of all calories consumed in the region [70].

According to FAOSTAT, China produces more wheat than any other country, followed by India, Russia, and the United States. China alone produces more than 134 million tonnes of wheat every year. The country has 24 million hectares dedicated to growing wheat, which is an area roughly the same size as Algeria.

Ukraine annually produces 26 million tons of wheat. Wheat is grown all across Ukraine, with the majority of yields being contributed by the central and south-central regions of the country. The crop is planted in the fall season and harvested between June and July the following year. Once popularly referred to as “the breadbasket of Europe”, Ukraine predominately produces the hard variant of winter wheat which is used in breadmaking [62].

Models predict that by 2050 consumers will require 60 percent more wheat than today. World population is expected to reach 7.9 billion by the year 2025. Provided that global per capita wheat consumption is virtually unchanged, it is projected that 786 million tonnes of wheat per year will be required for human use in 2025. This underscores the need to rapidly and continuously increase wheat production. Greater wheat production can be achieved in two ways: (I) by expanding the wheat area; and (II) by improving the yield per unit area sown. In addition, reducing pre- and post-harvest losses would make more wheat available for consumption [9,70].

## **II. Learn the following word – combinations.**

|                      |                                |
|----------------------|--------------------------------|
| a) basic staple food | 1) основний продукт харчування |
| b) beyond limits     | 2) за межами                   |
| c) wheat consumption | 3) споживання пшениці          |
| d) expand the area   | 4) розширити площу             |

## **III. Show general understanding of the text answering the questions**

1. What was the basic staple food of the major civilizations?
2. Where can wheat be grown?
3. In what countries is wheat the dominant staple?
4. What is the volume of wheat production in China?
5. When is wheat planted and harvested in Ukraine?
6. What are the ways of increasing wheat production?

## **IV. Agree or disagree with the following statements.**

1. The cultivation of wheat began long ago.
2. Wheat can not be grown near the Arctic Circle.
3. An area of wheat growing is equivalent to that of Greenland.
4. Wheat is eaten by 2.5 billion people in 70 countries.
5. China has 24 million hectares dedicated to growing wheat.
6. Wheat is grown only in the central and south-central regions of Ukraine.

**V. Fill in the blanks with the correct words and phrases from the word bank**

**Word bank - higher elevations, hard variant, losses, dominant staple, wheat, domesticated**

1. Wheat was one of the first ..... food crops.
2. Wheat can be grown from within the Arctic Circle to .... near the equator.
3. Wheat is the .... in North Africa and West and Central Asia.
4. China alone produces more than 134 million tonnes of .... every year.
5. Ukraine predominately produces the .... of winter wheat which is used in breadmaking.
6. Reducing pre- and post-harvest .... would make more wheat available for consumption.

**VI. Match the words (1- 3) with the definitions (A-C).**

- 1 - annual
  - 2 - temperature
  - 3 - consumption
- A) .... is the processes of taking food into the body through the mouth.
- B) .... is the measurement of something's heat.
- C) An .... is a plant that completes its life in one year.

## **Text 29**

### **Vegetable hybridization**

**I. Read and translate the text.**

Farming and plant breeding have been closely associated since the early days when crops were first domesticated. Plant breeders play a key role in determining what we eat, since the cultivars they develop begin the dietary food chain. Every food product, including vegetables, that we see on the market has benefited from plant breeding.

In the 18th and 19th centuries the Vilmorin-Andrieux family, owner of the first commercial seed company, played an important role in a number of the theoretical and technical advances in commercial vegetable breeding, such as producing the first vegetable seed catalog for horticulturists, developing the principles of genealogical breeding programs, improving seed quality through cross-breeding initiatives, and creating disease-resistant and hybrid cultivars of vegetables.

The first suggestion to exploit hybrid vigor, or heterosis, in vegetables was made by Hayes and Jones (1916) for cucumber. Commercial hybridization of vegetable species began in the United States in the middle 1920s with sweet corn, followed by onions in the 1940s. Since that time, private breeding companies have been placing more and more emphasis on the development of vegetable hybrids, and many species of vegetables have been bred as hybrid cultivars for the market place.

In 2008 the global vegetable seed market was estimated at US \$3.5 billion with these shares of vegetables: solanaceous (30%), cucurbits (21%), roots and bulbs (16%), brassicas (13%), large seed (13%), leafy and other (7%) (Monsanto 2009). In recent years global commercial vegetable seed sales had an annual growth rate of 5.8%.

With the increase in world population and consumption and the advent of a high degree of added value through biotechnology, the global market of vegetable seeds is expected to expand in future years [14].

## II. Match the following word – combinations.

|                       |                           |
|-----------------------|---------------------------|
| a) plant breeder      | 1) гібридна енергія       |
| b) food chain         | 2) стійкий до хвороб      |
| c) vegetable breeding | 3) темп зростання         |
| d) cross-breeding     | 4) овочівництво           |
| e) disease-resistant  | 5) харчовий ланцюг        |
| f) hybrid vigor       | 6) перехресне схрещування |
| g) growth rate        | 7) селекціонер            |

## III. Learn the following words.

|             |                   |
|-------------|-------------------|
| sweet corn  | цукрова кукурудза |
| cucumber    | огірок            |
| solanaceous | пасльонові        |
| cucurbits   | гарбузові         |
| roots       | коренеплоди       |
| brassicas   | капустяні         |
| leafy       | листові           |

## IV. Show general understanding of the text answering the questions

1. Why is the role of plant breeders so important in determining what we eat?
2. How was seed quality improved?
3. Who made the first suggestion to exploit hybrid vigor in vegetables?
4. Where did commercial hybridization of vegetable species begin?

5. What are the prerequisites of the expansion of the global market of vegetable seeds in future years?

**V. Agree or disagree with the following statements.**

1. Cultivars begin the dietary food chain.
2. The first vegetable seed catalog for horticulturists was produced in 20 century.
3. The Vilmorin-Andrieux family greatly contributed in the development of principles of genealogical breeding programs.
4. Hayes and Jones made the first suggestion to exploit heterosis in vegetables for sweet corn.
5. Since 1940s private breeding companies began developing vegetable hybrids.

**VI. Fill in the blanks with the correct words and phrases from the word bank.**

**Word bank - added value, hybrid cultivars, vegetable seed, market, plant breeding.**

1. Farming and .... have been closely associated since the early days.
2. Every food product that we see on the .... has benefited from plant breeding.
3. Many species of vegetables have been bred as .... for the market place.
4. In recent years global commercial .... sales had an annual growth rate of 5.8%.
5. Biotechnology promotes the advent of a high degree of ....

## **Text 30**

### **Vegetable migration**

**I. Read and translate the text.**

The introduction and trade of crops and seeds from one region to another has been continuous throughout history due to the migration of people, conquests, discoveries, and development of commercial trade routes. The «Silk Route», for example, was responsible for many plant exchanges and trades between the West and China. Vegetables, in particular, are attractive candidates for introduction into a new environment, as most vegetables tend to be fairly short-season crops and, as a consequence, lend themselves for cultivation in many diverse areas. Superior vegetable crops and cultivars often are assimilated into the cuisine of the indigenous populations. Worldwide there

has been, and continues to be, substantial emigration of peoples from a diverse range of countries. As people immigrated to new countries, they carried not only languages, religions, and traditional customs but foods and seeds.

In western Europe and in the United States, immigration has had a pronounced effect on the vegetables consumed. For example, in the 1960s, southern Europeans immigrated to work in the northwestern European industrial zone, bringing with them their distinct consumer behavior patterns and vegetable preferences. They were responsible for the introduction of broccoli, eggplant, pepper and fennel. Portuguese immigrants carried tronchuda cabbages to Brazil in the 16th century and to France and Germany in the 1960s.

The introduction and popularity of a small number of new vegetable crops in some countries have resulted in a steady increase in their utilization. For example, Chinese cabbage and pak-choy were novelties in much of the United States in the 1970s but are now widely consumed due to the immigration of Asiatic people. Likewise, since the 1970s, sweet corn consumption has increased in several European countries.

Nowadays many cities in the United States are excellent examples of increasing ethnic diversity and its impact on the vegetables available. Ethnic markets sprang up followed by shopping malls catering to Chinese, Korean, Vietnamese, or Hispanic populations. Vegetables such as Thai eggplant, tindora, parval, cactus leaves, and others are now readily found in ethnic American markets. New vegetables also have moved into traditional markets, as superior crops are accepted by the general public, greatly enriching the diversity of vegetables grown and consumed [14].

## II. Learn the following words.

|                    |                                         |
|--------------------|-----------------------------------------|
| chinese cabbage    | китайська капуста                       |
| pak-choy           | пак-чой                                 |
| tronchuda cabbages | капуста трончуда, португальська капуста |
| parval             | парвал, парвальський гарбуз             |
| tindora            | тіндора, плющовий гарбуз                |
| Thai eggplant      | тайський баклажан                       |

## III. Match the following word – combinations.

|                      |                         |
|----------------------|-------------------------|
| a) trade route       | 1) торговий центр       |
| b) pronounced effect | 2) етнічне різноманіття |
| c) behavior patterns | 3) торговий шлях        |
| d) ethnic diversity  | 4) постійне зростання   |
| e) malls catering    | 5) виражений ефект      |
| f) steady increase   | 6) модель поведінки     |

#### **IV. Agree or disagree with the following statements.**

1. The “Silk Route” was responsible for many plant exchanges and trades between the West and China.
2. There is substantial emigration of peoples from a diverse range of countries.
3. In the 1960s, southern Europeans immigrated to work in the northeastern European industrial zone.
4. Chinese cabbage and pak-choy are now widely consumed due to the immigration of Asiatic people.

#### **V. Fill in the blanks with the correct words and phrases from the word bank.**

**Word bank - sweet corn, cabbage, foods and seeds, immigrants.**

1. As people immigrated to new countries, they carried not only traditional customs but ....
2. Since the 1970s, .... consumption has increased in several European countries.
3. Chinese .... and pak-choy are now widely consumed due to the immigration of Asiatic people.
4. Portuguese .... carried tronchuda cabbages to Brazil in the 16<sup>th</sup> century.

### **Text 31**

#### **The global fungicides market**

##### **I. Read and translate the text.**

Fungicides are pesticides that are being used to prevent and control the growth of fungi and spore diseases. Fungal infections severely affect crops, and fungicides prevent or mitigate damage caused by fungi to plants and agricultural crops. Over the past five years, fungicide utilization has grown substantially in a variety of crops mainly fruits, vegetable, cereals, and rice [22,41].

The global fungicides market is estimated to be valued at USD 18.7 billion in 2019 and is projected to reach USD 24.5 billion by 2025 [39]. Fungicide companies Syngenta AG (Switzerland), Bayer (Germany), BASF SE (Germany), DuPont (US), and LANXESS AG (Germany) are some of the suppliers of fungicides [20,22].

The global fungicides market has been segmented based on type, crop type, mode of application, and region. By type, the fungicides have been divided into chemical fungicides and biofungicides. The chemical fungicides segment is further classified into Benzimidazoles, Dithiocarbamates, Triazoles, Phenylamides, and others. Based on crop type, the global fungicides market has been classified into cereals and grains, oilseeds and pulses, fruits and vegetables, and others. Based on mode of application, the fungicides have been segmented as seed treatment, foliar, soil treatment, and others [19, 20].

The development of biofungicides with the least or no effect on the environment provides growth opportunities for manufacturers in the fungicides market. Biological fungicides or biofungicides comprise beneficial microorganisms that are used to control fungal diseases. Many of these beneficial microorganisms are naturally found in the soil. Biofungicides are mostly used before the occurrence of disease. They help in improving the nutrient uptake of certain elements and also can be used in rotation with conventional fungicides to reduce the risk of resistance development [20].

Strong population growth and increasing demand for food production are expected to drive the fungicides market further [22].

## II. Match the following word – combinations.

|                             |                                     |
|-----------------------------|-------------------------------------|
| a) fungal infections        | 1) пом'якшити пошкодження           |
| b) prevent damage           | 2) корисні мікроорганізми           |
| c) mitigate damage          | 3) боротися з хворобами             |
| d) fungicides market        | 4) поглинання поживних речовин      |
| e) mode of application      | 5) виробництво продуктів харчування |
| f) seed treatment           | 6) спосіб застосування              |
| g) soil treatment           | 7) попередити пошкодження           |
| h) beneficial microorganism | 8) ринок фунгіцидів                 |
| i) control diseases         | 9) обробка насіння                  |
| j) occurrence of disease    | 10) зростаючий попит                |
| k) nutrient uptake          | 11) грибова інфекція                |
| l) increasing demand        | 12) обробіток ґрунту                |
| m) food production          | 13) виникнення захворювання         |

## III. Show general understanding of the text answering the questions

1. What is a purpose of using fungicides?
2. What companies are suppliers of fungicides?
3. On what basis has the global fungicides market been segmented?
4. How are fungicides divided by type?
5. How were fungicides segmented according to mode of application?

**IV. Agree or disagree with the following statements.**

1. Fungicides prevent or mitigate damage caused by fungi to plants.
2. Classification of the global fungicides market into cereals and grains, oilseeds and pulses, fruits and vegetables was made according to the crop type.
3. The global fungicides market is projected to reach USD 24.5 billion by 2050.
4. Biofungicides comprise beneficial microorganisms.
5. Biofungicides are mostly used after the occurrence of disease.

**V. Fill in the blanks with the correct words and phrases from the word bank.**

**Word bank – rotation, fungicides market, microorganisms, uptake, crops.**

1. Fungicide utilization has grown substantially in a variety of....
2. Beneficial .... are used to control fungal diseases.
3. Fungicides help in improving the nutrient .... of certain elements.
4. Fungicides can be used in .... with conventional fungicides to reduce the risk of resistance development.
5. An increasing demand for food production is expected to drive the global.... further.

## PART V

### GRAMMAR TESTS

**Test I. Виконайте тест. З чотирьох запропонованих варіантів виберіть один правильний.**

1. Buckwheat .... well on black and meliorated peat soils.  
A) grow                                  C) to grow  
B) grows                                 D) growing
2. Yellow leaves .... by too many factors.  
A) can cause                            C) is caused  
B) can be caused                      D) causes
3. He .... his car a month ago.  
A) bought                                C) buys  
B) has bought                          D) buy
4. Winter rye is the .... of all cereals.  
A) hardy                                  C) very hardy  
B) hardier                                D) hardest
5. Plants grown and .... by the farmer are known as farm crops.  
A) cultivating                            C) cultivate  
B) cultivated                             D) to cultivate
6. Look! The dog .... with the ball.  
A) plays                                  C) play  
B) are playing                          D) is playing
7. The time of planting depends .... the climatic conditions.  
A) of                                        C) by  
B) on                                        D) at
8. Dicots leaves .... often .... into leaflets.  
A) is ... subdivided                    C) was ... subdivided  
B) are ... subdivided                  D) will ... subdivide
9. The grass flower .... an important example of wind pollination.  
A) are                                      C) is  
B) be                                        D) been
10. We .... to the tennis club since we moved here.  
A) have belonged                        C) belonged  
B) belong                                 D) are belonging

**Test II. Виконайте тест. З чотирьох запропонованих варіантів виберіть один правильний.**

1. A root normally .... underground.  
A) grows                      C) to grow  
B) growing                  D) grow
2. Buckwheat needs ....water to grow well.  
A) many                      C) the least  
B) the most                 D) much
3. Only plants .... the green pigment chlorophyll can photosynthesize.  
A) containing                C) contain  
B) is containing             D) contained
4. They .... to the zoo yesterday.  
A) have gone                C) went  
B) go                         D) going
5. Insecticides are short lived if the rain .... the leaf.  
A) wash                      C) to wash  
B) washing                  D) washes
6. The second function of the root .... the plant.  
A) are to anchor             C) is to anchor  
B) to anchor                 D) is anchoring
7. He lives in .... Paris.  
A) –                          C) a  
B) the                         D) an
8. Green maturity is one of the .... methods to maintain crop production.  
A) older                      C) old  
B) the oldest                 D) as old as
9. Calcium .... to make cell walls.  
A) is used                    C) is using  
B) are used                  D) using
10. I was sure that I .... him before.  
A) am meeting               C) had met  
B) meet                      D) met

**Test III. Виконайте тест. З чотирьох запропонованих варіантів виберіть один правильний.**

- Fats .... more chemical energy than carbohydrates.  
A) contains                      C) contain  
B) to contain                  D) is containing
- The farm .... now .... the problem of full mechanization of farm work.

- A) is ... solving                      C) has ... solved  
 B) was ... solving                    D) will ... solve
3. .... trees are very tall.  
 A) The                                      C) An  
 B) A                                         D) This
4. To obtain the .... yield from our crops we must prepare the seed bed carefully.  
 A) highest                                C) higher  
 B) high                                     D) little
5. The root system must .... well to function properly.  
 A) be developed                        C) is developed  
 B) developed                            D) to develop
6. He .... his car when it started to rain.  
 A) was cleaning                        C) cleaned  
 B) cleans                                 D) clean
7. Nitrogen .... the most dramatic effect on the leaf growth.  
 A) have                                    C) has  
 B) to have                                D) having
8. We have .... grasses to improve soil fertility.  
 A) grow                                    C) grows  
 B) grew                                    D) grown
9. Rotation implies the growing of .... than one crop on a farm.  
 A) many                                  C) more  
 B) most                                    D) much
10. Despite yesterday's snowfalls, we ... home in less than an hour.  
 A) can drive                              C) are able to drive  
 B) may drive                             D) were able to drive

**Test IV. Виконайте тест. З чотирьох запропонованих варіантів виберіть один правильний.**

1. Most of the crop plants .... in the British Isles are herbaceous.  
 A) grow                                    C) will grow  
 B) grown                                 D) grew
2. The leaf .... the photosynthetic factory of the plant.  
 A) is                                        C) been  
 B) be                                        D) were
3. Do you enjoy .... in the park?  
 A) walk                                    C) walks  
 B) to walk                                D) walking

4. Two hundred frost-free days .... to mature a variety of cotton.  
 A) requires                                      C) is requiring  
 B) are required                                D) was required
5. The stem of rye is .... than there of wheat.  
 A) longer                                        C) long  
 B) longest                                       D) very long
6. Mum went to the bank .... some money.  
 A) get                                            C) getting  
 B) to get                                        D) gets
7. Heavy soils usually .... much clay.  
 A) containing                                C) to contain  
 B) contains                                    D) contain
8. Stem is one of the .... parts of the plant.  
 A) important                                  C) more important  
 B) most important                        D) very important
9. There .... always .... great variation in the quality of soils available for agriculture.  
 A) is ... been                                C) have ... been  
 B) has ... been                              D) are ... been
10. She swam strongly and .... cross the river easily, even though it was swollen by the heavy rain.  
 A) can                                          C) is able to  
 B) was able to                                D) could

**Test V. Виконайте тест. З чотирьох запропонованих варіантів виберіть один правильний.**

1. Wheat, barley and sugar beet .... slowly at temperatures above 40 F.  
 A) germinating                                C) germinate  
 B) germinates                                D) to germinate
2. Some wheat .... in autumn.  
 A) sow                                          C) will sow  
 B) sown                                        D) is sown
3. All crops cannot ....well if the soil is poor.  
 A) grow                                        C) to grow  
 B) grew                                        D) growing
4. Many plants need two years .... their cycle of growth.  
 A) complete                                  C) to complete  
 B) completed                                D) completes
5. While Paul .... Mary was reading a magazine.

- A) swam C) was swimming
- B) swims D) were swimming
6. Dark coloured soils are considered to be .... than light – coloured ones.  
A) more productive C) very productive  
B) productive D) most productive
7. .... apple in my bag is fresh.  
A) a C) an  
B) the D) –
8. From earliest time wheat .... an important role as a human food.  
A) play C) have played  
B) has played D) playing
9. Light soils .... water so much.  
A) do not hold C) does not hold  
B) are not hold D) is not hold
10. She .... her holiday in Finland.  
A) told me about C) said me about  
B) said about D) told about

**Test VI. Виконайте тест. З чотирьох запропонованих варіантів виберіть один правильний.**

1. Sulfur is .... for protein formation.  
A) needs C) need  
B) needed D) to need
2. The most common colours of soils .... the different shades of red, yellow and brown.  
A) be C) is  
B) are D) been
3. Oats are the third .... cereal crop in the USA.  
A) more important C) most important  
B) much important D) much more important
4. Did you .... Madame Tussauds while in London?  
A) visiting C) to visit  
B) visits D) visit
5. Annual plants are plants that .... only one season.  
A) to live C) lives  
B) live D) living
6. There is .... in the box. It's empty.  
A) nothing C) anything  
B) something D) anybody

7. Are there .... trees in the park?  
A) much  
B) many  
C) a lot of  
D) some
8. We .... to be at the office at 9 o'clock every morning.  
A) should  
B) must  
C) have  
D) has
9. Some soils .... much more care because of their structure.  
A) requires  
B) to require  
C) require  
D) requiring
10. Look at ..... It's very bright tonight.  
A) the moons  
B) moon  
C) the moon  
D) a moon

**Test VII. Виконайте тест. З чотирьох запропонованих варіантів виберіть один правильний.**

1. The organic matter of the soil .... decomposed residues of the vegetation.  
A) consists of                                      C) consisting of  
B) consist of                                      D) to consist
2. Nitrogen .... a crucial nutrient for growing plants.  
A) be                                                  C) were  
B) are                                                D) is
3. They .... their homework yet.  
A) haven't finished                              C) has finished  
B) finished                                        D) hasn't finished
4. Soil organic matter .... extensively .... by microorganisms.  
A) are ...transformed                              C) is ... transformed  
B) were ...transformed                             D) have been ...transformed
5. The earlier the land is warmed up in spring, .... the tillage operations may be started.  
A) the sooner                                      C) the soonest  
B) soon                                              D) very soon
6. Mother's day is celebrated .... May.  
A) in                                                  C) on  
B) with                                                D) at
7. Without trace elements the plant cannot .... properly.  
A) grow                                              C) to grow  
B) growing                                          D) grew
8. Fertile soil is one which .... the capacity to supply nutrients for high crop production.

- |           |              |
|-----------|--------------|
| A) have   | C) has       |
| B) having | D) is having |
8. Wheat is best .... to fertile medium-to-heavy soils that are well drained.
- |             |             |
|-------------|-------------|
| A) adapted  | C) adapt    |
| B) adapting | D) to adapt |
9. Sydney is .....
- |                       |                         |
|-----------------------|-------------------------|
| A) beautiful city     | C) a beautiful city     |
| B) the beautiful city | D) the beautiful cities |

**Test VIII. Виконайте тест. З чотирьох запропонованих варіантів виберіть один правильний.**

1. The sun is the prime source of soil heat, and the .... vertically the rays fall upon the soil, the more heat is received.
- |         |         |
|---------|---------|
| A) many | C) much |
| B) more | D) most |
2. The rainfall cannot ....by the man, but one can do much to save water after it falls.
- |                     |                  |
|---------------------|------------------|
| A) be influenced    | C) is influenced |
| B) to be influenced | D) influenced    |
3. I'll give it to her when she .... back.
- |             |              |
|-------------|--------------|
| A) comes    | C) will come |
| B) had come | D) coming    |
4. They have been driving .... four hours.
- |        |          |
|--------|----------|
| A) for | C) since |
| B) ago | D) at    |
5. He .... his leg, so he can't play football.
- |               |                |
|---------------|----------------|
| A) has broken | C) is breaking |
| B) breaks     | D) break       |
6. If food is organic it .... without unnatural fertilizers or pesticides.
- |                 |                  |
|-----------------|------------------|
| A) are produced | C) were produced |
| B) is produced  | D) produce       |
7. There isn't .... in the shop. It's closed.
- |            |             |
|------------|-------------|
| A) anybody | C) somebody |
| B) nobody  | D) someone  |
8. Some of the constituents of plants .... as food by the soil microorganisms.
- |            |             |
|------------|-------------|
| A) use     | C) are used |
| B) is used | D) is using |
9. Against her parent's wishes, she wants to be ....

- A) the journalist                      C) a journalist
  - B) journalist                          D) journalists
10. .... breakfast every morning?
- A) Do you have                      C) Are you having
  - B) Did you have                      D) Have you had

**Test IX. Виконайте тест. З чотирьох запропонованих варіантів виберіть один правильний.**

1. The physical properties of a soil ....by its texture and structure.
  - A) determine                      C) determines
  - B) is determined                      D) are determined
2. You put too .... sugar in my tea. I can't drink it now.
  - A) many                      C) enough
  - B) much                      D) more
3. The production of adenosine triphosphate can .... the rate of photosynthesis.
  - A) regulating                      C) to regulate
  - B) regulate                      D) regulates
4. It's .... cold to go out.
  - A) too                      C) enough
  - B) more                      D) most
5. The root .... an outer layer of cell called the epidermis.
  - A) have                      C) has
  - B) to have                      D) were having
6. Some plants grow in environments where there is ....water in the soil.
  - A) many                      C) a few
  - B) few                      D) much
7. How long .... you lived here?
  - A) are                      C) have
  - B) were                      D) has
8. What .... Pam doing yesterday at 3 o'clock?
  - A) was                      C) were
  - B) is                      D) are
9. Ian has lived in Rome .... 2007.
  - A) when                      C) for
  - B) at                      D) since
10. Peter has .... been good in Maths.
  - A) ever                      C) since
  - B) never                      D) for

## **ENGLISH – UKRAINIAN DICTIONARY**

| <b>A</b>      |                             |
|---------------|-----------------------------|
| ability       | здатність                   |
| abnormally    | аномально, неправильно      |
| above         | над, вище, понад            |
| aboveground   | над землею                  |
| absorb        | абсорбувати, всмоктувати    |
| abundant      | рясний                      |
| accept        | приймати                    |
| access        | доступ                      |
| accommodate   | приспосовуватися, вміщувати |
| according to  | згідно з                    |
| accustom      | звикати, привчати           |
| acid          | кислота                     |
| acorn         | жолудь                      |
| activation    | активація                   |
| activity      | діяльність, активність      |
| adapt         | адаптувати, пристосовувати  |
| addition      | домішка, доповнення         |
| additional    | додатковий                  |
| adequate      | відповідний, достатній      |
| adjucent      | суміжний                    |
| advantage     | перевага                    |
| advent        | поява                       |
| adventitious  | побічний, додатковий        |
| advertise     | рекламувати, повідомляти    |
| aerial        | повітряний, надземний       |
| aeroponics    | аеропоніка                  |
| affect        | впливати                    |
| aggregate     | загальний, спільний         |
| aggregation   | скупчення                   |
| aggregoponics | агрегатопоніка              |
| agriculture   | сільське господарство       |
| angiosperms   | покритонасінні              |
| air           | повітря                     |
| albuminous    | білковий, альбуміновий      |
| alfalfa       | люцерна                     |
| algae         | водорості                   |
| allow         | дозволяти, допускати        |
| along         | вздовж                      |
| aminoacid     | амінокислота                |
| ammonia       | аміак                       |
| amount        | кількість                   |

|                 |                                          |
|-----------------|------------------------------------------|
| anchor          | закріплювати                             |
| angiosperms     | покритонасінні рослини                   |
| animal          | тварина                                  |
| annually        | щорічно                                  |
| apical          | верхівковий, горішній                    |
| appear          | з'являтися                               |
| appearance      | зовнішній вигляд                         |
| appendage       | придаток, відросток, насіннєвий придаток |
| aquatic         | водний                                   |
| arable          | орний                                    |
| area            | ділянка, район                           |
| arise           | виникати, здійснюватися                  |
| arrangement     | розташування, розміщення, пристосування  |
| asparagus       | спаржа                                   |
| associate       | об'єднувати, сполучати                   |
| attach          | прикріплювати                            |
| attachment      | прикріплення                             |
| attract         | залучати                                 |
| attractive      | привабливий                              |
| available       | наявний, доступний                       |
| avoid           | уникати                                  |
| <b>В</b>        |                                          |
| balloon         | повітряна куля                           |
| bark            | кора                                     |
| barley          | ячмінь                                   |
| base            | основа, обґрунтовувати                   |
| bean            | квасоля, боби                            |
| bear            | переносити, витримувати, нести           |
| beauty          | краса                                    |
| become          | ставати                                  |
| beef            | яловичина                                |
| beekeeping      | бджільництво                             |
| beet            | буряк                                    |
| begin           | починати                                 |
| behavior        | поведінка, ставлення                     |
| below           | нижче                                    |
| belt            | смуга, пояс                              |
| bend            | нахилитися, вигинати                     |
| benefit         | перевага, користь                        |
| berry           | ягода                                    |
| bisexual        | гермафродит                              |
| blackberry      | ожина                                    |
| black mangroves | чорні мангри                             |
| blow            | дути                                     |

|                 |                                                                           |
|-----------------|---------------------------------------------------------------------------|
| boat            | лодка                                                                     |
| boron           | бор                                                                       |
| bougainvillea   | бугенвілія                                                                |
| bran            | висівки                                                                   |
| branch          | галузь, гілка                                                             |
| breadbasket     | житниця                                                                   |
| break up        | розбивати                                                                 |
| breed           | порода, розводити                                                         |
| breeding        | розведення                                                                |
| bright          | яскравий                                                                  |
| bring           | приносити                                                                 |
| broad           | широкий                                                                   |
| broccoli        | броколі                                                                   |
| bubble          | міхур, пузир                                                              |
| buckwheat       | гречка                                                                    |
| build-in        | вбудований                                                                |
| building        | будівля                                                                   |
| bulb            | цибулина                                                                  |
| bulbs           | цибулинні ( <i>бот</i> )                                                  |
| bull            | бик                                                                       |
| bulk            | маса                                                                      |
| <b>С</b>        |                                                                           |
| calcium         | кальцій                                                                   |
| call            | викликати, називати                                                       |
| calyx           | чашечка                                                                   |
| cap             | чохол, верхівка                                                           |
| capacity        | ємкість, здатність, продуктивність                                        |
| capsule         | оболонка, мембрана, капсула                                               |
| carbohydrate    | вуглевод                                                                  |
| carbon dioxide  | вуглекислий газ                                                           |
| carrot          | морква                                                                    |
| carry           | переносити                                                                |
| catalyst        | каталізатор                                                               |
| cataphyll       | катафілл, первинна форма листка ;<br>недорозвинений, (лусковидний) листок |
| cattle          | велика рогата худоба                                                      |
| cattle breeding | скотарство                                                                |
| cause           | причина, спричиняти                                                       |
| cell            | клітина                                                                   |
| cellular        | клітинний, пористий                                                       |
| cereals         | злакові                                                                   |
| chance          | можливість, нагода, траплятися                                            |
| chemical        | хімікат                                                                   |
| chemoponics     | хемопоніка                                                                |

|                 |                                            |
|-----------------|--------------------------------------------|
| cherry          | вишня                                      |
| chestnut        | каштановий                                 |
| chinese cabbage | китайська капуста                          |
| chlorine        | хлор                                       |
| chlorophyll     | хлорофіл                                   |
| choice          | вибір                                      |
| choose          | вибирати                                   |
| classify        | класифікувати                              |
| clay            | глина                                      |
| clog            | засмічувати, перешкоджати                  |
| close           | зачиняти, близько, поруч                   |
| coating         | покриття                                   |
| coleoptile      | колеоптіль                                 |
| coleorhiza      | колеориза                                  |
| collective      | збірний, спільний, загальний               |
| color           | колір                                      |
| community       | громада                                    |
| comparatively   | відносно, порівняно                        |
| compare         | порівнювати                                |
| complete        | завершувати, комплектувати, досконалий     |
| completely      | повністю, цілком                           |
| compose of      | складатися з                               |
| composition     | склад, набір                               |
| compound        | складний                                   |
| comprise        | складати                                   |
| conditions      | умови                                      |
| conifers        | хвойні породи                              |
| cone            | шишка, конус                               |
| connect         | з'єднувати, зв'язувати, асоціювати         |
| conquest        | завоювання, підкорення                     |
| consist of      | складатися з                               |
| constant        | постійний                                  |
| constituent     | складова                                   |
| consume         | споживати, знищувати                       |
| contain         | містити                                    |
| contamination   | забруднення, зараження                     |
| content         | зміст, об'єм, обсяг                        |
| contribute      | сприяти, вносити                           |
| conversion      | перетворення, трансформація                |
| cool            | прохолодний, охолоджувати, поглинати тепло |
| copper          | мідь                                       |
| core            | стрижень, ядро                             |
| coriander       | коріандр                                   |
| corn            | кукурудза                                  |

|               |                                    |
|---------------|------------------------------------|
| corolla       | віночок                            |
| cotyledon     | сім'ядоля                          |
| cow           | корова                             |
| crop          | сільськогосподарська культура      |
| cucumber      | огірок                             |
| cultivar      | сорт                               |
| current       | поточний, сучасний                 |
| custom        | звичай                             |
| <b>D</b>      |                                    |
| dairy         |                                    |
| damage        | пошкодження, шкода                 |
| dandelion     | кульбаба                           |
| dark          | темний                             |
| dark-green    | темно-зелений                      |
| darkness      | темрява                            |
| decay         | гнити                              |
| decide        | вирішувати                         |
| decompose     | розкладатися                       |
| decomposition | гниття, розщеплення                |
| decrease      | зменшення, зменшувати              |
| deep          | глибокий                           |
| defense       | захист                             |
| deficient     | недостатній, дефіцитний            |
| degree        | ступінь                            |
| dense         | щільний, густий                    |
| density       | щільність, густина, концентрація   |
| depth         | глибина                            |
| derive        | походити, брати початок            |
| desert        | пустеля                            |
| desirable     | бажаний                            |
| desturb       | порушувати, турбувати              |
| determine     | визначати                          |
| detour        | обхід, обходити                    |
| detritus      | уламки, детрит                     |
| develop       | розвиватися, рости, розгортатися   |
| development   | розвиток                           |
| dicots        | дводольні                          |
| difference    | різниця                            |
| different     | різний                             |
| differentiate | розрізняти, розмежовувати          |
| diffuse       | розповсюджувати                    |
| diffusion     | поширення, розповсюдження          |
| direct        | керувати, спрямовувати, призначати |
| disadvantage  | недолік                            |

|               |                               |
|---------------|-------------------------------|
| discovery     | відкриття                     |
| disease       | хвороба                       |
| disintegrate  | розпадатися, вивітрюватися    |
| dispersal     | поширення, розсіювання        |
| disseminate   | поширювати, розповсюджувати   |
| distal        | дистальний                    |
| distinct      | окремий, несхожий             |
| disturbance   | порушення                     |
| diverse       | різноманітний, неоднаковий    |
| divide        | ділити, розділяти             |
| division      | поділ, розподіл, класифікація |
| dormant       | в стані спокою                |
| down          | вниз, донизу                  |
| downside      | зворотний бік                 |
| downward      | вниз, донизу                  |
| drain         | витікати, стікати, відводити  |
| drowning      | утоплення                     |
| drup          | костянка                      |
| dry           | сухий, висушувати             |
| dryness       | сухість                       |
| during        | під час                       |
| <b>Е</b>      |                               |
| edge          | край, кромка                  |
| edible        | їстівні                       |
| effect        | вплив                         |
| eggplant      | баклажан                      |
| elimination   | очищення, ліквідація          |
| elongation    | подовження, продовження       |
| embryo        | ембріон, зародок              |
| emerge        | виникати, з'являтися          |
| enable        | робити можливим, давати змогу |
| encase        | обрамляти                     |
| enclose       | оточувати, обмежувати         |
| enlarge       | збільшувати                   |
| enrich        | збагачувати                   |
| ensure        | забезпечити                   |
| enterprise    | підприємство, справа          |
| environment   | навколишнє середовище         |
| environmental | зовнішній                     |
| enzymatic     | ферментативний                |
| enzyme        | фермент                       |
| equally       | однаково, порівну             |
| equation      | рівняння                      |
| equipment     | обладнання                    |

|               |                                                                                                             |
|---------------|-------------------------------------------------------------------------------------------------------------|
| erosion       | ерозія                                                                                                      |
| essential     | істотний, суттєвий, основний                                                                                |
| estimate      | оцінювати                                                                                                   |
| evidence      | свідчення, свідчити, доводити                                                                               |
| evaporation   | випаровування                                                                                               |
| evolve        | розвиватися                                                                                                 |
| exalbuminous  | безбілковий                                                                                                 |
| excellent     | відмінний                                                                                                   |
| excessive     | надмірний, зайвий                                                                                           |
| exchange      | обмін                                                                                                       |
| exclusive     | винятковий, першокласний                                                                                    |
| excretion     | виведення, виділення                                                                                        |
| exhibit       | експонат, показувати                                                                                        |
| expansion     | поширення, <i>бот.</i> розпускання, розростання                                                             |
| exploit       | використовувати                                                                                             |
| exposure      | опромінення, незахищеність                                                                                  |
| extension     | розширення, розповсюдження                                                                                  |
| <b>F</b>      |                                                                                                             |
| facilitate    | полегшити                                                                                                   |
| fall          | осінь                                                                                                       |
| farm          | ферма                                                                                                       |
| farmer        | фермер                                                                                                      |
| farming       | господарство, землеробство                                                                                  |
| favorable     | сприятливий                                                                                                 |
| feather       | перо, пушинка                                                                                               |
| feed          | корм                                                                                                        |
| feet          | фут                                                                                                         |
| fennel        | фенхель                                                                                                     |
| fertile       | родючий                                                                                                     |
| fertility     | родючість                                                                                                   |
| fertilization | запліднення, запилення                                                                                      |
| fiber         | клітковина, волокно, волокнистий шар ( <i>в стулках бобів овочевої квасолі</i> ), прожилка ( <i>бот.</i> ), |
| fibrous       | волокнистий                                                                                                 |
| field         | поле, ділянка                                                                                               |
| fig           | інжир                                                                                                       |
| fir           | ялиця                                                                                                       |
| firmness      | твердість, міцність                                                                                         |
| fitness       | придатність                                                                                                 |
| flat          | плоский, рівнинний                                                                                          |
| flax          | льон                                                                                                        |
| fleshy        | м'ясистий                                                                                                   |
| flood         | потік, вилив, потоп, повінь                                                                                 |
| floral        | квітковий                                                                                                   |

|             |                                  |
|-------------|----------------------------------|
| flower      | квітка                           |
| food        | їжа, харчування                  |
| forest      | ліс                              |
| form        | форма, формувати                 |
| formation   | формування, утворення, структура |
| formidable  | нездоланний, величезний          |
| fragrance   | аромат                           |
| frequent    | частий                           |
| fruiting    | плодоношення                     |
| fullness    | повнота, огрядність              |
| function    | функція                          |
| furniture   | меблі                            |
| further     | додатковий, подальший            |
| fuse        | зливатися                        |
| <b>G</b>    |                                  |
| gas         | газ                              |
| gene        | ген                              |
| genera      | сорт, вид, рід                   |
| generally   | загалом, звичайно                |
| generate    | створювати                       |
| genus       | рід, сорт, вид                   |
| germinate   | проростати                       |
| germination | проростання                      |
| ginger      | імбир                            |
| gland       | залоза                           |
| gourd       | гарбуз посудний, лагенарія       |
| grain       | зерно                            |
| gram        | нут                              |
| groove      | борозенка, борозна               |
| ground      | земля                            |
| grow        | рости, вирощувати                |
| grower      | виробник, садівник, овочівник    |
| growth      | зростання, вирощування, ріст     |
| gullyng     | ерозія ярів, яроутворення        |
| gymnosperms | голонасінні рослини              |
| <b>H</b>    |                                  |
| habitat     | природне середовище              |
| hair        | волосина                         |
| hard        | дерев'янистий                    |
| harvest     | урожай                           |
| hemp        | конопля                          |
| herbaceous  | трав'яний, трав'янистий          |
| herbivores  | травоїдні                        |
| hickory     | гікорі, карія, олійний горіх     |

|                |                                              |
|----------------|----------------------------------------------|
| high           | високий, заввишки                            |
| hilum          | рубчик                                       |
| hold           | утримувати, зберігати                        |
| honeylocust    | медовий пилок                                |
| hook           | причепити, зачепити, заціпати                |
| hop            | хміль                                        |
| horse chestnut | кінський каштан                              |
| host           | господар                                     |
| hull           | шкірка (насінини); плівка (зерна)            |
| humans         | люди                                         |
| humidity       | вологість                                    |
| hypocotyl      | гіпокотиль                                   |
| <b>I</b>       |                                              |
| identical      | однаковий, тотожний                          |
| identify       | визначати, розпізнавати                      |
| immense        | неосяжний, величезний                        |
| impact         | вплив                                        |
| important      | важливий                                     |
| include        | включати до складу, містити в собі           |
| increase       | зростати, збільшувати, зростання, приріст    |
| independent    | незалежний                                   |
| inflated       | роздутий                                     |
| inflorescence  | суцвіття                                     |
| influence      | вплив, впливати                              |
| ingenious      | дотепний                                     |
| insect         | комаха                                       |
| insert         | вміщувати, вставляти                         |
| inside         | всередині, внутрішній                        |
| instance       | екземпляр, зразок                            |
| intersperse    | перемежовувати, різноманітнити               |
| introduction   | введення, запровадження                      |
| involve        | залучати                                     |
| ionitoponics   | іонітопоніка                                 |
| iron           | залізо                                       |
| ivy            | плющ                                         |
| <b>K</b>       |                                              |
| knowledge      | знання                                       |
| <b>L</b>       |                                              |
| lack           | відсутність, відчувати нестачу, не вистачати |
| large          | великий                                      |
| lateral        | бічний, боковий                              |
| lavender       | лаванда                                      |
| lawn           | газон, галявина                              |
| layer          | шар, пласт                                   |

|              |                                          |
|--------------|------------------------------------------|
| leaching out | вилюговування                            |
| leaflike     | листоподібний                            |
| leafy        | листяний, листовий                       |
| leathery     | шкірястий                                |
| leave        | листок                                   |
| legume       | біб ( <i>тип плода</i> ), бобова рослина |
| length       | довжина                                  |
| lifespan     | тривалість життя                         |
| light        | легкий, світлий, світло, освітлення      |
| livestock    | худоба                                   |
| lobe         | частка                                   |
| locate       | розташовувати                            |
| loess        | льос, льосова порода                     |
| long         | довгий, протяжний                        |
| loose        | розпушений, відв'язувати                 |
| loss         | втрата                                   |
| low          | низький                                  |
| <b>М</b>     |                                          |
| magnesium    | магній                                   |
| main         | основний, головний                       |
| maintain     | підтримувати                             |
| major        | основний                                 |
| make         | здійснювати, робити                      |
| manganese    | марганець                                |
| mangroves    | мангрові зарослі                         |
| manufacture  | виготовлення                             |
| maple        | клен                                     |
| marigold     | нагідки, календула                       |
| market       | ринок                                    |
| maternal     | материнський                             |
| matter       | матерія, речовина                        |
| maturation   | дозрівання, визрівання                   |
| mature       | зрілий, дозрівати                        |
| maturity     | зрілість, стиглість                      |
| meat         | м'ясо                                    |
| media        | середовище                               |
| medium       | середній, помірний                       |
| melon        | диня                                     |
| membranous   | перетинчастий                            |
| mention      | згадувати, посилатися                    |
| meristem     | меристема                                |
| micropyle    | мікропіле                                |
| millet       | просо                                    |
| miss         | пропускати, минати                       |

|                 |                                   |
|-----------------|-----------------------------------|
| misshapen       | деформований                      |
| mistletoe       | омела                             |
| mitigate        | пом'якшити                        |
| mixture         | суміш                             |
| modify          | видозмінювати                     |
| moisture        | вологість                         |
| molecule        | молекула                          |
| monocots        | однодольні                        |
| moreover        | крім того, причому, зате          |
| move            | рухатися                          |
| movement        | рух                               |
| mulch           | мульча                            |
| multiple        | складовий, багаторазовий          |
| <b>N</b>        |                                   |
| nature          | природа                           |
| need            | необхідність                      |
| network         | мережа, плетіння, сітка           |
| nitrate         | нітрат, азотнокисла сіль          |
| nitrogen        | азот                              |
| nitrogen-fixing | азот-фіксуючий                    |
| node            | вузол                             |
| nodule          | вузол                             |
| nopalitos       | нопалітос                         |
| north           | північ                            |
| northwest       | північний захід                   |
| novelty         | нововведення, новина              |
| nucleic acid    | нуклеїнова кислота                |
| nutrients       | поживні речовини                  |
| nutrition       | харчування                        |
| <b>O</b>        |                                   |
| oat             | овес                              |
| obtain          | отримувати                        |
| occupy          | займати, заповнювати              |
| occur           | траплятися                        |
| offer           | пропонувати                       |
| oil             | олія                              |
| oilseeds        | олійні культури                   |
| onion           | цибуля                            |
| opening         | отвір, щілина                     |
| opponent        | супротивний, розташований напроти |
| orchard         | сад                               |
| orchid          | орхідея                           |
| ordinary        | звичайний                         |
| organelle       | органела                          |

|                |                                          |
|----------------|------------------------------------------|
| organic        | органічний                               |
| orientate      | орієнтуватися, розбиратися               |
| outer          | зовнішній                                |
| outermost      | зовнішній                                |
| outside        | зовні                                    |
| outward        | назовні, зовнішній, видимий, навколишній |
| ovary          | зав'язь, яєчник                          |
| ovule          | насінний зачаток, яйцеклітина            |
| oxygen         | кисень                                   |
| oxygenate      | окислювати                               |
| <b>Р</b>       |                                          |
| palisade       | стовпчастий                              |
| papery         | паперовий                                |
| parent         | батьківський                             |
| part           | частина                                  |
| particles      | частинки                                 |
| particular     | окремий, особливий                       |
| particularly   | особливо, докладно                       |
| pattern        | тип, система, модель                     |
| peach          | персик                                   |
| peanut         | арахіс, земляний горіх                   |
| pear           | груша                                    |
| penetrate      | проникати                                |
| pepper         | перець                                   |
| percentage     | процент                                  |
| perennial      | багаторічний                             |
| perform        | виконувати                               |
| perfume        | аромат, пахощі                           |
| perlite        | перліт                                   |
| persistence    | витривалість, наполегливість             |
| pest           | шкідники                                 |
| pesticides     | пестициди                                |
| petal          | пелюсток                                 |
| phosphate      | фосфат                                   |
| phosphatides   | фосфатиди                                |
| phosphorus     | фосфор                                   |
| photosynthates | продукти фотосинтезу                     |
| phototropism   | фототропізм                              |
| pin            | шпилька, штифт                           |
| pinapple       | ананас                                   |
| pine           | сосна                                    |
| pinecone       | шишка                                    |
| pistachio      | фісташка                                 |
| plain          | рівнина                                  |

|                |                                        |
|----------------|----------------------------------------|
| plant          | рослина, садити                        |
| plant breeding | рослинництво                           |
| plastid        | пластида                               |
| please         | подобатися                             |
| podzolized     | опідзолений                            |
| point          | позначка, точка, пункт, місце          |
| pollen         | пилек                                  |
| pollination    | запилення                              |
| pollution      | забруднення                            |
| pome           | яблуко (тип плоду)                     |
| poor           | бідний, поганий                        |
| poppy          | мак                                    |
| pores          | пори                                   |
| portion        | частка, частина, доля                  |
| possess        | володіти, мати                         |
| potassium      | калій                                  |
| potato         | картопля                               |
| poultry        | домашня птиця                          |
| prairie        | прерія, степовий                       |
| preference     | перевага, уподобання                   |
| premise        | передумова                             |
| presence       | наявність, присутність                 |
| pressure       | тиск, напруга                          |
| prevent        | запобігти, попередити                  |
| primary        | первинний, головний, основний, простий |
| proceed        | продовжувати, тривати                  |
| process        | обробляти                              |
| produce        | виробляти                              |
| production     | виробництво                            |
| profound       | глибокий, повний, змістовний           |
| prohibit       | забороняти                             |
| promote        | сприяти                                |
| prone          | бути схильним                          |
| proper         | відповідний, справжній                 |
| property       | властивість                            |
| protect        | захищати                               |
| protection     | захист                                 |
| protein        | білок                                  |
| provide        | забезпечувати                          |
| pull           | тягнути, смикати                       |
| pump           | насос                                  |
| purpose        | мета                                   |
| push           | штовхати, прискорювати, натиск         |
| putrid         | гнилий                                 |

| Q            |                         |
|--------------|-------------------------|
| quality      | якість                  |
| quantity     | кількість               |
| quarter      | чверть                  |
| R            |                         |
| radiate      | випромінювати           |
| radiation    | випромінювання          |
| radical      | прикореневий            |
| radicle      | зародковий корінець     |
| rainforest   | тропічний ліс           |
| raise        | виросувати              |
| ranche       | ранчо                   |
| range        | діапазон, серія, напрям |
| rape         | рапс                    |
| raphe        | насінний рубчик         |
| raspberry    | малина                  |
| rate         | рівень                  |
| ratio        | співвідношення          |
| reach        | досягати, охопити       |
| reason       | причина                 |
| recognize    | розпізнати, визнавати   |
| recycle      | переробляти             |
| redbud       | червоний бутон          |
| reduce       | зменшити, скорочувати   |
| redwood      | червоне дерево          |
| refer        | посилатися, звертатися  |
| regime       | режим, порядок          |
| regrow       | відростати              |
| regulate     | регулювати              |
| relative     | відносний, умовний      |
| remain       | залишатися              |
| remember     | пам'ятати               |
| repeat       | повторювати             |
| reproductive | відтворювальний         |
| require      | потребувати, вимагати   |
| requirement  | вимога, потреба         |
| resemble     | бути схожим, нагадувати |
| reservoir    | басейн, резервуар, бак  |
| reside       | перебувати, належати    |
| resistance   | опір, витривалість      |
| respectively | відповідно              |
| respiration  | дихання                 |
| respond      | реагувати, відповідати  |
| response     | відповідь, реакція      |

|             |                             |
|-------------|-----------------------------|
| responsible | відповідальний              |
| rest        | решта                       |
| result      | впливати                    |
| retain      | утримувати, зберегти        |
| retention   | утримання                   |
| reticulate  | сітчастий                   |
| reveal      | виявляти, з'ясовувати       |
| rice        | рис                         |
| rich        | багатий                     |
| ripe        | стиглий                     |
| rock        | скеля, порода               |
| role        | роль                        |
| root        | корінь                      |
| <b>S</b>    |                             |
| salt        | сіль                        |
| samara      | крилатка                    |
| sand        | пісок                       |
| scar        | рубець                      |
| scutellum   | щиток                       |
| secret      | виділяти                    |
| seed        | насіння, сіяти              |
| seedling    | сіянець, розсада, проросток |
| sell        | продавати                   |
| separate    | окремий, самостійний        |
| separately  | окремо                      |
| separation  | роз'єднання                 |
| serve       | слугувати                   |
| several     | декілька                    |
| shallow     | неглибокий, мілкий          |
| shade       | затінити, тінь, затінок     |
| shape       | форма, вигляд               |
| sheaths     | оболонка, піхви             |
| shield      | щиток                       |
| shoot       | паросток, пагін, брунька    |
| shortage    | нестача                     |
| showy       | ефектний                    |
| shrubs      | чагарники                   |
| side        | сторона                     |
| sign        | прикмета, ознака            |
| silt        | мул                         |
| similar     | подібний                    |
| simple      | простий                     |
| single      | окремий, одиночний          |
| site        | місце                       |

|             |                                   |
|-------------|-----------------------------------|
| situate     | розміщувати                       |
| size        | розмір                            |
| slight      | незначний                         |
| slope       | схил, узгір'я                     |
| slow down   | гальмувати, сповільнювати         |
| soil        | грунт                             |
| solar       | сонячний                          |
| solonetz    | солонець                          |
| soluble     | розчинний                         |
| solution    | розчин                            |
| solvent     | розчинник                         |
| source      | джерело, основа                   |
| south       | південь                           |
| southeast   | південний схід                    |
| species     | види                              |
| specific    | особливий, спеціальний            |
| speed up    | прискорити                        |
| spice       | спеція                            |
| spongy      | губчастий, абсорбуючий            |
| spray       | розпилювач, обприскувач           |
| spring      | весна                             |
| squash      | гарбуз великоплідний              |
| stalk       | черешок, стебло                   |
| stand       | насадження                        |
| staple      | основний товар                    |
| starch      | крохмаль                          |
| steep       | крутий                            |
| stem        | стебло                            |
| sting       | жалити                            |
| stomata     | продихи                           |
| storage     | зберігання                        |
| store       | запасати, зберігати, накопичувати |
| strawberry  | полуниця                          |
| strength    | сила, міцність                    |
| strong      | сильний                           |
| stunt       | затримувати ріст або розвиток     |
| stunted     | низькорослий, чахлий              |
| subsequent  | наступний                         |
| substance   | речовина                          |
| substantial | істотний, поживний, основний      |
| successful  | успішний                          |
| succulents  | сукуленти, (м'ясисті плоди)       |
| suffer      | страждати, зазнавати              |
| sufficient  | достатній                         |

|               |                                             |
|---------------|---------------------------------------------|
| sugar         | цукор                                       |
| suit          | задовольняти, пристосовувати                |
| sulfur        | сірка                                       |
| summer        | літо                                        |
| sunflower     | соняшник                                    |
| sunlight      | сонячне світло                              |
| supply        | постачати                                   |
| support       | підтримувати, сприяти                       |
| surface       | поверхня                                    |
| surpass       | перевершити, переважати                     |
| surround      | оточувати, обступати                        |
| survival      | виживання                                   |
| survive       | вижити                                      |
| suspend       | підвішувати, вішати, відкладати             |
| sustainable   | стійкий                                     |
| sweet corn    | цукрова кукурудза                           |
| <b>T</b>      |                                             |
| tend          | мати тенденцію                              |
| term          | термін, умова, висловлювати                 |
| terminal      | періодичний, кінцевий                       |
| testa         | теста, насіннева оболонка, насіннева шкірка |
| thick         | завтовшки, густий, товстий                  |
| thickness     | товщина                                     |
| thin          | тонкий                                      |
| through       | через, крізь, протягом                      |
| tilt          | нахил                                       |
| tip           | верхівка, кінчик                            |
| tissue        | тканина ( <i>біол.</i> )                    |
| together      | разом                                       |
| top           | верхівка                                    |
| tough         | жорсткий, міцний, твердий                   |
| toward        | назустріч                                   |
| transfer      | передавати, переносити                      |
| transition    | перехід                                     |
| transpiration | транспірація (виділення води рослинами)     |
| trade         | торгівля                                    |
| trap          | пастка, капкан                              |
| tree          | дерево                                      |
| trunk         | стовбур                                     |
| tumbo (tree)  | дерево тумбо                                |
| tune          | налаштувати                                 |
| turnip        | ріпа                                        |
| type          | тип                                         |
| <b>U</b>      |                                             |

|                   |                                    |
|-------------------|------------------------------------|
| unbranched        | нерозгалужений                     |
| undergo           | зазнавати, витримувати             |
| underground       | підземний                          |
| underneath        | нижній, прихований                 |
| union             | спілка, об'єднання                 |
| unique            | унікальний, особливий, неповторний |
| unlike            | на відміну від                     |
| uplands           | високогір'я, нагір'я               |
| upper             | верхній                            |
| upwards           | вгору                              |
| utilization       | вживання                           |
| <b>V</b>          |                                    |
| vacuole           | вакуолі                            |
| valuable          | цінний                             |
| value             | цінність, вартість                 |
| vapor             | пара                               |
| variation         | різновид                           |
| various           | різний, різноманітний              |
| vary              | відрізнятися, мінятися             |
| vascular          | судинний                           |
| vegetable         | овоч                               |
| vegetation        | рослинність                        |
| vegetative        | вегетативний                       |
| vermiculite       | вермикуліт                         |
| viable            | життєздатний                       |
| view              | вид, ландшафт                      |
| vineyard          | виноградник                        |
| visual            | наочний, візуальний                |
| vitamin           | вітамін                            |
| <b>W</b>          |                                    |
| wall              | стінка                             |
| walnut            | волоський горіх                    |
| water             | вода                               |
| water lily        | водяна лілія                       |
| water melon       | кавун                              |
| watermeal (plant) | водяна мука (рослина)              |
| watering          | полив, зрошення                    |
| waxy              | воскоподібний                      |
| weakness          | слабкість, недостатність           |
| weeds             | бур'яни                            |
| wheat             | пшениця                            |
| weathering        | вивітрювання, ерозія               |
| wide              | широкий                            |
| widespread        | широко розповсюджений, поширений   |

|              |                            |
|--------------|----------------------------|
| wilt, wither | в'янути, опадати           |
| wind         | вітер                      |
| wood         | дерешина                   |
| world        | світ                       |
| worldwide    | всесвітній, в усьому світі |
| <b>Y</b>     |                            |
| yield        | урожай, урожайність        |
| <b>Z</b>     |                            |
| zinc         | цинк                       |

## **UKRAINIAN - ENGLISH DICTIONARY**

|                            |                            |
|----------------------------|----------------------------|
| <b>A</b>                   |                            |
| абсорбувати                | absorb                     |
| агрегатопоніка             | aggregoponics              |
| адаптувати, пристосовувати | adapt                      |
| аеропоніка                 | aeroponics                 |
| азот                       | nitrogen                   |
| азотфіксуючий              | nitrogen-fixing            |
| активація                  | activation                 |
| альбуміновий, білковий     | albuminous                 |
| аміак                      | ammonia                    |
| амінокислота               | aminoacid                  |
| ананас                     | pinapple                   |
| аномально                  | abnormally                 |
| арахіс, земляний горіх     | peanut                     |
| аромат, пахощі             | perfume, fragrance         |
| <b>B</b>                   |                            |
| багатий                    | rich                       |
| багаторічний               | perennial                  |
| бажаний                    | desirable                  |
| баклажан                   | eggplant                   |
| басейн, резервуар, бак     | reservoir                  |
| батьківський               | parent                     |
| бджільництво               | beekeeping                 |
| безбілковий                | exalbuminous, exalbuminose |
| бик                        | bull                       |
| біб ( <i>тип плода</i> )   | legume                     |
| бідний, поганий            | poor                       |
| білковий, альбуміновий     | albuminous                 |
| білок                      | protein                    |
| бічний, боковий            | lateral                    |
| бобова рослина             | legume                     |

|                                        |                        |
|----------------------------------------|------------------------|
| бор                                    | boron                  |
| борозна, борозенка                     | groove                 |
| буряк                                  | beet                   |
| буряк цукровий                         | sugar beet, white beet |
| буряк листовий, мангольд               | leaf beet, silver beet |
| буряк столовий (червоний)              | red beet               |
| бур'ян                                 | weed                   |
| будівля                                | building               |
| <b>В</b>                               |                        |
| важливий                               | important              |
| вакуолі                                | vacuole                |
| вбудований                             | build-in               |
| введення, запровадження                | introduction           |
| вгору                                  | upwards                |
| вегетативний                           | vegetative             |
| велика рогата худоба                   | cattle                 |
| великий                                | large                  |
| вермикуліт                             | vermiculite            |
| верхівка, кінчик                       | tip, top               |
| верхній                                | upper                  |
| весна                                  | spring                 |
| вживання                               | utilization            |
| вздовж                                 | along                  |
| вибирати                               | choose                 |
| вибір                                  | choice                 |
| виведення, виділення                   | excretion              |
| вивітрювання, ерозія                   | weathering             |
| виготовлення                           | manufacture            |
| вид, рід, сорт                         | genus, species         |
| вид, ландшафт                          | view                   |
| виділяти                               | secret                 |
| визначати                              | determine              |
| визначення, детермінація, встановлення | determination          |
| виконувати                             | perform                |
| використовувати                        | exploit                |
| вилуговування                          | leaching out           |
| вимога, потреба                        | requirement            |
| виникати, здійснюватися                | arise                  |
| виноградник                            | vineyard               |
| винятковий, першокласний               | exclusive              |

|                                              |                   |
|----------------------------------------------|-------------------|
| випаровування                                | evaporation       |
| випливати                                    | result            |
| випромінювання                               | radiation         |
| випромінювати                                | radiate           |
| вирішувати                                   | decide            |
| виробляти                                    | produce           |
| виробник                                     | grower            |
| виробництво                                  | production        |
| вироснути                                    | raise             |
| висівки                                      | bran              |
| високий, заввишки                            | high              |
| високогір'я, нагір'я                         | uplands           |
| витікати, стікати, відводити                 | drain             |
| витривалість, наполегливість                 | persistence       |
| вишня                                        | cherry            |
| виявляти, з'ясовувати                        | reveal            |
| відкриття                                    | discovery         |
| відмінний                                    | excellent         |
| відносно, порівняно                          | comparatively     |
| відносний, умовний                           | relative          |
| відрізнятися, мінятися                       | vary              |
| відростати                                   | regrow            |
| відповідальний                               | responsible       |
| відповідний, достатній                       | adequate          |
| відповідно                                   | respectively      |
| відповідь, реакція                           | response          |
| відсоток                                     | percentage        |
| відсутність, відчувати нестачу, не вистачати | lack              |
| відтворювальний                              | reproductive      |
| віночок                                      | corolla           |
| вітамін                                      | vitamin           |
| вітер                                        | wind              |
| включати до складу, містити в собі           | include           |
| властивість                                  | property          |
| вміщувати, вставляти                         | insert            |
| вниз, донизу                                 | down, downward    |
| володіти, мати                               | possess           |
| вода                                         | water             |
| водний                                       | aquatic           |
| водорості                                    | algae             |
| водяна лілія                                 | water lily        |
| водяна мука                                  | watermeal (plant) |

|                                                                |                      |
|----------------------------------------------------------------|----------------------|
| вологість                                                      | humidity, moisture   |
| волокнистий                                                    | fibrous              |
| волокно, волокнистий шар<br>(в стулках бобів овочевої квасолі) | fiber                |
| волосина                                                       | hair                 |
| волоський горіх                                                | walnut               |
| воскоподібний                                                  | waxy                 |
| вплив                                                          | impact, influence    |
| впливати                                                       | affect, influence    |
| всередині, внутрішній                                          | inside               |
| всесвітній, в усьому світі                                     | worldwide            |
| втрата                                                         | loss                 |
| вуглевод                                                       | carbohydrate         |
| вуглекислий газ                                                | carbon dioxide       |
| вузол                                                          | node, nodule         |
| в'янути, опадати                                               | wilt, wither         |
| <b>Г</b>                                                       |                      |
| газ                                                            | gas                  |
| газон, галявина                                                | lawn                 |
| галузь, гілка                                                  | branch               |
| гальмувати, сповільнювати                                      | slow down            |
| гарбуз великоплідний                                           | squash               |
| гарбуз посудний, лагенарія                                     | gourd                |
| ген                                                            | gene                 |
| гермафродит                                                    | bisexual             |
| гікорі, карія, олійний горіх                                   | hickory              |
| гіпокотиль                                                     | hypocotyl            |
| глибина                                                        | depth                |
| глибокий, потужний (про ґрунт)                                 | deep                 |
| глибокий, повний, змістовний                                   | profound             |
| глина                                                          | clay                 |
| гнилий                                                         | putrid               |
| гниття, розпад, розщеплення                                    | decay, decomposition |
| голонасінні рослини                                            | gymnosperms          |
| горіх                                                          | nut                  |
| господар                                                       | host                 |
| гречка                                                         | buckwheat            |
| громада                                                        | community            |
| ґрунт                                                          | soil                 |
| груша                                                          | pear                 |
| губчастий, абсорбуючий                                         | spongy               |
| <b>Д</b>                                                       |                      |
| давати змогу, робити можливим                                  | enable               |
| дводольні                                                      | dicots               |

|                                        |                     |
|----------------------------------------|---------------------|
| декілька                               | several             |
| деревина                               | wood                |
| дерево                                 | tree                |
| дерево тумбо                           | tumbo (tree)        |
| дерев'янистий                          | hard                |
| детермінація, визначення, встановлення | determination       |
| детрит, уламки                         | detritus            |
| деформований                           | misshapen           |
| джерело, основа                        | source              |
| диня                                   | melon               |
| дистальний                             | distal              |
| дихання                                | respiration         |
| діапазон, серія, напрям                | range               |
| ділити, розділяти                      | divide              |
| ділянка, район                         | area                |
| діяльність, активність                 | activity            |
| довгий, протяжний                      | long                |
| довжина                                | length              |
| доглядати, обслуговувати               | tend                |
| додатковий                             | additional, further |
| дозволяти, допускати                   | allow               |
| дозрівання, визрівання                 | maturation          |
| домашня птиця                          | poultry             |
| домішка, доповнення                    | addition            |
| достатній                              | sufficient          |
| доступ                                 | access              |
| доступний, наявний                     | available           |
| досягати, охопити                      | reach               |
| дотепний                               | ingenious           |
| дути                                   | blow                |
| <b>Е</b>                               |                     |
| екземпляр, зразок                      | instance            |
| експонат                               | exhibit             |
| ембріон, зародок                       | embryo              |
| ерозія                                 | erosion             |
| ефект, вплив                           | effect              |
| ефектний                               | showy               |
| <b>Є</b>                               |                     |
| ємність, здатність, продуктивність     | capacity            |
| <b>Ж</b>                               |                     |
| жалити                                 | sting               |
| живлення, засвоєння поживних речовин   | nutrition           |

|                                        |                          |
|----------------------------------------|--------------------------|
| житниця                                | breadbasket              |
| жито                                   | rye                      |
| життєздатний                           | viable                   |
| жолудь                                 | acorn                    |
| жорсткий, міцний, твердий              | tough                    |
| <b>3</b>                               |                          |
| забезпечити                            | ensure                   |
| забезпечувати                          | provide                  |
| забороняти                             | prohibit                 |
| забруднення, зараження                 | contamination, pollution |
| завершувати, комплектувати, досконалий | complete                 |
| завоювання, підкорення                 | conquest                 |
| завтовшки, густий, товстий             | thick                    |
| зав'язь, яєчник                        | ovary                    |
| загалом, звичайно                      | generally                |
| загальний, спільний                    | aggregate                |
| задовольняти, пристосовувати           | suit                     |
| знавати, витримувати                   | undergo                  |
| займати, заповнювати                   | occupy                   |
| закріплювати                           | anchor                   |
| залишатися                             | remain                   |
| залізо                                 | iron                     |
| залоза                                 | gland                    |
| залучати                               | attract, involve         |
| запасати, зберігати, накопичувати      | store                    |
| запилення                              | pollination              |
| запліднення, запилення                 | fertilization            |
| запобігти, попередити                  | prevent                  |
| зародковий корінець                    | radicle                  |
| засмічувати, перешкоджати              | clog                     |
| затіняти, тінь, затінок                | shade                    |
| затримувати ріст або розвиток          | stunt                    |
| захист                                 | protection, defense      |
| захищати                               | protect                  |
| зачиняти, близько, поруч               | close                    |
| збагачувати                            | enrich                   |
| зберігання                             | storage                  |
| збільшувати                            | enlarge                  |
| збірний, спільний, загальний           | collective               |
| звичайний                              | ordinary                 |
| звикати, привчати                      | accustom                 |
| звичай                                 | custom                   |
| зворотній бік                          | downside                 |

|                                                                       |                                 |
|-----------------------------------------------------------------------|---------------------------------|
| згадувати, посилалися                                                 | mention                         |
| згідно з                                                              | according to                    |
| здатність                                                             | ability                         |
| здійснювати, робити                                                   | make                            |
| землеробство                                                          | farming                         |
| земля                                                                 | ground                          |
| зерно                                                                 | grain                           |
| зернові, хлібний злак                                                 | cereal                          |
| злакові                                                               | cereals                         |
| зливатися                                                             | fuse                            |
| зменшення, зменшувати                                                 | decrease                        |
| зменшити, скорочувати                                                 | reduce                          |
| зміст, об'єм, обсяг                                                   | content                         |
| знання                                                                | knowledge                       |
| зовні                                                                 | outside                         |
| зовнішній                                                             | environmental, outer, outermost |
| зовнішній вигляд                                                      | appearance                      |
| зрілий, дозрівати                                                     | mature                          |
| зрілість, стиглість                                                   | maturity                        |
| з'являтися, виникати                                                  | appear, emerge                  |
| з'єднувати, зв'язувати, асоціювати                                    | connect                         |
| <b>I</b>                                                              |                                 |
| імбир                                                                 | ginger                          |
| інжир                                                                 | fig                             |
| іонітопоніка                                                          | ionitoponics                    |
| істотний, суттєвий, основний                                          | essential, substantial          |
| <b>І</b>                                                              |                                 |
| їстівні                                                               | edible                          |
| <b>К</b>                                                              |                                 |
| калій                                                                 | potassium                       |
| кальцій                                                               | calcium                         |
| картопля                                                              | potato                          |
| каталізатор                                                           | catalyst                        |
| катафілл, первинна форма листка; недорозвинений, (лусковидний) листок | cataphyll                       |
| каштановий                                                            | chestnut                        |
| квасоля, біб                                                          | bean                            |
| квітка                                                                | flower                          |
| квітковий                                                             | floral                          |
| кисень                                                                | oxygen                          |
| кислота                                                               | acid                            |
| кількість                                                             | amount, quantity                |

|                            |                |
|----------------------------|----------------|
| кінський каштан            | horse chestnut |
| класифікувати              | classify       |
| клен                       | maple          |
| клітина                    | cell           |
| клітинний                  | cellular       |
| клітковина                 | cellulose      |
| колеоптиль                 | coleoptile     |
| колеориза                  | coleorhiza     |
| колір                      | color          |
| комаха                     | insect         |
| кавун                      | water melon    |
| конопля                    | hemp           |
| кора                       | bark           |
| коріандр                   | coriander      |
| корм, харчування           | food, feed     |
| корова                     | cow            |
| користь, перевага          | benefit        |
| корінь                     | root           |
| костянка                   | drup           |
| край, кромка               | edge           |
| краса                      | beauty         |
| крилатка                   | samara         |
| крохмаль                   | starch         |
| крутий                     | steep          |
| кукурудза                  | corn           |
| кульбаба                   | dandelion      |
| <b>Л</b>                   |                |
| лаванда                    | lavender       |
| лагенарія, гарбуз посудний | gourd          |
| листок                     | leave          |
| листоподібний              | leaflike       |
| листяний, листовий         | leafy          |
| ліс                        | forest         |
| літо                       | summer         |
| лодка                      | boat           |
| люди                       | humans         |
| люцерна                    | alfalfa        |
| льон                       | flax           |
| льоc, льосова порода       | loess          |
| <b>М</b>                   |                |
| магній                     | magnesium      |
| мак                        | poppy          |
| малина                     | raspberry      |
| мангрові зарослі           | mangroves      |

|                                             |             |
|---------------------------------------------|-------------|
| марганець                                   | manganese   |
| маса                                        | bulk        |
| материнський                                | maternal    |
| матерія, речовина                           | matter      |
| меблі                                       | furniture   |
| мережа, плетіння, сітка                     | network     |
| меристема                                   | meristem    |
| мета                                        | purpose     |
| мідь                                        | copper      |
| мікропіле                                   | micropyle   |
| містити                                     | contain     |
| місце                                       | site        |
| міхур                                       | bubble      |
| можливість, нагода                          | chance      |
| молекула                                    | molecule    |
| молочний                                    | dairy       |
| морква                                      | carrot      |
| мул                                         | silt        |
| мульча                                      | mulch       |
| м'ясистий                                   | fleshy      |
| м'ясо                                       | meat        |
| <b>Н</b>                                    |             |
| на відміну від                              | unlike      |
| навколишнє середовище                       | environment |
| нагідки, календула                          | marigold    |
| над землею                                  | aboveground |
| надмірний, зайвий                           | excessive   |
| назовні, зовнішній, видимий,<br>навколишній | outward     |
| назустріч                                   | toward      |
| налаштувати                                 | tune        |
| наочний, візуальний                         | visual      |
| насадження                                  | stand       |
| насінний зачаток, яйцеклітина               | ovule       |
| насінний рубчик                             | raphe       |
| насіння, насіннєвий матеріал,<br>сіяти      | seed        |
| насос                                       | pump        |
| наступний                                   | subsequent  |
| нахил                                       | tilt        |
| нахилятися, вигинати                        | bend        |
| наявний, доступний                          | available   |
| наявність, присутність                      | presence    |
| неглибокий, мілкий                          | shallow     |

|                                 |               |
|---------------------------------|---------------|
| недолік                         | disadvantage  |
| недостатній, дефіцитний         | deficient     |
| незалежний                      | independent   |
| незначний                       | slight        |
| необхідність                    | need          |
| неосяжний, величезний           | immense       |
| нерозгалужений                  | unbranched    |
| несправжнє стебло, піхва (бот.) | sheaths       |
| нестача                         | shortage      |
| нестача води                    | lack of water |
| нести, переносити               | carry         |
| нижній, прихований              | underneath    |
| нижче                           | below         |
| низький                         | low           |
| низькорослий, чахлий            | stunted       |
| нітрат, азотнокисла сіль        | nitrate       |
| нововведення, новина            | novelty       |
| нопалітос                       | nopalitos     |
| нуклеїнова кислота              | nucleic acid  |
| нут                             | gram          |
| <b>О</b>                        |               |
| обладнання                      | equipment     |
| обмін                           | exchange      |
| оболонка, мембрана, капсула     | capsule       |
| обрамляти                       | encase        |
| обробляти                       | process       |
| обступати, оточувати            | surround      |
| обхід, обходити                 | detour        |
| об'єднувати, сполучати          | associate     |
| овес                            | oat           |
| овоч, овочева культура          | vegetable     |
| овочівник                       | grower        |
| огірок                          | cucumber      |
| одиначний, окремий              | single        |
| однаковий, тотожний             | identical     |
| однаково, порівну               | equally       |
| однодольні                      | monocots      |
| ожина                           | blackberry    |
| окислювати                      | oxygenate     |
| окремо                          | separately    |
| окремий, самостійний            | separate      |
| олійні культури                 | oilseeds      |
| олія                            | oil           |
| омела                           | mistletoe     |

|                                        |              |
|----------------------------------------|--------------|
| опідзолений                            | podzolized   |
| опір, витривалість                     | resistance   |
| опромінення, незахищеність             | exposure     |
| органели                               | organelles   |
| органічний                             | organic      |
| орієнтуватися, розбиратися             | orientate    |
| орний                                  | arable       |
| орхідея                                | orchid       |
| осінь                                  | fall         |
| основа                                 | base         |
| основний, головний                     | main, major  |
| особливий, окремий                     | particular   |
| особливо, докладно                     | particularly |
| отвір, щілина                          | opening      |
| оточувати, обмежувати                  | enclose      |
| отримувати                             | obtain       |
| оцінювати                              | estimate     |
| очищення, ліквідація                   | elimination  |
| <b>П</b>                               |              |
| пам'ятати                              | remember     |
| паперовий                              | papery       |
| пара                                   | vapor        |
| паросток, пагін, брунька               | shoot        |
| пастка, капкан                         | trap         |
| пелюсток                               | petal        |
| первинний, головний, основний, простий | primary      |
| перебувати, належати                   | reside       |
| перевага, уподобання                   | preference   |
| перевершити, переважати                | surpass      |
| передавати, переносити                 | transfer     |
| передумова                             | premise      |
| переносити, витримувати, нести         | bear         |
| переробляти                            | recycle      |
| перетворення, трансформація            | conversion   |
| перетинчастий                          | membranous   |
| перехід                                | transition   |
| періодичний, кінцевий                  | terminal     |
| перліт                                 | perlite      |
| персик                                 | peach        |
| перо, пушинка                          | feather      |
| пестициди                              | pesticides   |
| пилок                                  | pollen       |
| пилок медовий                          | honeylocust  |

|                                  |                   |
|----------------------------------|-------------------|
| південь                          | south             |
| південний схід                   | southeast         |
| північ                           | north             |
| північний захід                  | northwest         |
| підвішувати, вішати, відкладати  | suspend           |
| підземний                        | underground       |
| підприємство, справа             | enterprise        |
| підтримувати, сприяти            | maintain, support |
| пісок                            | sand              |
| пластид                          | plastid           |
| плівка (зерна), шкірка (насінин) | hull              |
| плодоношення                     | fruiting          |
| плоский, рівнинний               | flat              |
| плющ                             | ivy               |
| побічний, додатковий             | adventitious      |
| поведінка, ставлення             | behavior          |
| поверхня                         | surface           |
| повітря                          | air               |
| повітряний, надземний            | aerial            |
| повітряна куля                   | balloon           |
| повністю, цілком                 | completely        |
| повнота, огрядність              | fullness          |
| повторювати                      | repeat            |
| подаліший                        | further           |
| подібний                         | similar           |
| поділ, розподіл, класифікація    | division          |
| подобатися                       | please            |
| подовження, продовження          | elongation        |
| поживна речовина                 | nutrient          |
| позначка, точка, пункт, місце    | point             |
| покритонасінні рослини           | angiosperms       |
| покриття                         | coating           |
| поле, ділянка                    | field             |
| полегшити                        | facilitate        |
| полив, зрошення                  | watering          |
| полуниця                         | strawberry        |
| пом'якшити                       | mitigate          |
| пори                             | pores             |
| порівнювати                      | compare           |
| порода, розводити                | breed             |
| порушення                        | disturbance       |
| посилатися, звертатися           | refer             |
| постачати                        | supply            |
| потік, вилив, потоп, повінь      | flood             |

|                                          |                |
|------------------------------------------|----------------|
| потребувати, вимагати                    | require        |
| походити, брати початок                  | derive         |
| починати                                 | begin          |
| поширений, широко розповсюджений,        | widespread     |
| поширення, розповсюдження                | diffusion      |
| поширювати, розповсюджувати              | disseminate    |
| пошкодження, шкода                       | damage         |
| поява                                    | advent         |
| прерія, степовий                         | prairie        |
| привабливий                              | attractive     |
| придатність                              | fitness        |
| придаток, насіннєвий придаток, відросток | appendage      |
| приймати                                 | accept         |
| прикмета, ознака                         | sign           |
| прикріпляти                              | attach         |
| прикріплення                             | attachment     |
| прикореневий                             | radical        |
| приносити                                | bring          |
| приріст, розмноження,                    | increase       |
| природа                                  | nature         |
| природне середовище                      | habitat        |
| прискорити                               | speed up       |
| приспосовуватися                         | accommodate    |
| причепити, зачепити, заціпати            | hook           |
| причина, спричиняти                      | cause, reason  |
| продавати                                | sell           |
| продихи                                  | stomata        |
| продовжувати, тривати                    | proceed        |
| продукти фотосинтезу                     | photosynthates |
| прожилка (бот.)                          | fiber          |
| проникати                                | penetrate      |
| пропонувати                              | offer          |
| пропускати, минати                       | miss           |
| проростання                              | germination    |
| проростати                               | germinate      |
| просо                                    | millet         |
| простий                                  | simple         |
| протягом, під час                        | during         |
| пустеля                                  | desert         |
| пшениця                                  | wheat          |
| <b>P</b>                                 |                |

|                                         |                     |
|-----------------------------------------|---------------------|
| разом                                   | together            |
| район, ділянка                          | area                |
| ранчо                                   | ranche              |
| рапс                                    | rape                |
| реагувати, відповідати                  | respond             |
| регулювати                              | regulate            |
| режим, порядок                          | regime              |
| рекламувати, повідомляти                | advertise           |
| речовина                                | substance           |
| решта                                   | rest                |
| ринок                                   | market              |
| рис                                     | rice                |
| рівень                                  | rate                |
| рівнина                                 | plain               |
| рівняння                                | equation            |
| рід, сорт, вид                          | genus               |
| різний                                  | different           |
| різниця                                 | difference          |
| різновид                                | variation           |
| різноманітти                            | intersperse         |
| різноманітний, неоднаковий              | diverse, various    |
| ріпа                                    | turnip              |
| ріст, вирощування                       | growth              |
| родючість                               | fertility           |
| родючий                                 | fertile             |
| розбивати                               | break up            |
| розведення                              | breeding            |
| розвиватися, рости, розгортатися        | develop, evolve     |
| розвиток                                | development         |
| роздутий                                | inflated            |
| роз'єднання                             | separation          |
| розмір                                  | size                |
| розміщувати                             | situate             |
| розпадатися, вивітрюватися              | disintegrate        |
| розпилювач, обприскувач                 | spray               |
| розпізнавати, визначати                 | identify, recognize |
| розпускання (бот.), розростання         | expansion           |
| розпушений, відв'язувати                | loose               |
| розрізняти, розмежовувати               | differentiate       |
| розсіювання, поширення                  | dispersal           |
| розташовувати                           | locate              |
| розташування, розміщення, пристосування | arrangement         |
| розчин                                  | solution            |

|                               |                        |
|-------------------------------|------------------------|
| розчинний                     | soluble                |
| розчинник                     | solvent                |
| розширення, розповсюдження    | extension              |
| роль                          | role                   |
| рослина, садити               | plant                  |
| рослинність                   | vegetation             |
| рости, вирощувати             | grow                   |
| рубець                        | scar                   |
| рубчик                        | hilum                  |
| рух                           | movement               |
| рухатися                      | move                   |
| рясний                        | abundant               |
| <b>С</b>                      |                        |
| сад                           | orchard                |
| садівник                      | grower                 |
| свідчення, свідчити, доводити | evidence               |
| світ                          | world                  |
| світло, освітлення            | light                  |
| середній, помірний            | medium                 |
| середовище                    | media                  |
| серцевина, ядро               | core                   |
| сила, міцність                | strength               |
| сіль                          | salt                   |
| сильний                       | strong                 |
| сільське господарство         | agriculture            |
| сільськогосподарська культура | crop                   |
| сім'ядоля                     | cotyledon              |
| сірка                         | sulfur                 |
| сітчастий                     | reticulate             |
| сіянець, розсада, проросток   | seedling               |
| скеля, порода                 | rock                   |
| склад, набір                  | composition            |
| складати                      | comprise               |
| складатися з                  | compose of, consist of |
| складний                      | compound               |
| складова                      | constituent            |
| складовий, багаторазовий      | multiple               |
| скотарство                    | cattle breeding        |
| скупчення                     | aggregation            |
| слабкість, недостатність      | weakness               |
| слугувати                     | serve                  |
| смуга, пояс                   | belt                   |
| солонець                      | solonetz               |
| сонячний                      | solar                  |

|                                      |                     |
|--------------------------------------|---------------------|
| сонячне світло                       | sunlight            |
| соняшник                             | sunflower           |
| сорт                                 | cultivar, variety   |
| сосна                                | pine                |
| спаржа                               | asparagus           |
| спеціальний, особливий               | specific            |
| спеція                               | spice               |
| співвідношення                       | ratio               |
| спілка, об'єднання                   | union               |
| сплячий, в стані спокою              | dormant             |
| споживати, знищувати                 | consume             |
| справжній, відповідний               | proper              |
| сприяти, вносити                     | promote, contribute |
| сприятливий                          | favorable           |
| ставати                              | become              |
| створювати                           | generate            |
| стебло                               | stem                |
| стиглий                              | ripe                |
| стійкий                              | sustainable         |
| стінка                               | wall                |
| стовбур                              | trunk               |
| стовпчастий                          | palisade            |
| сторона                              | side                |
| страждати, зазнавати                 | suffer              |
| стрижневий (головний) корінь         | tap root, main root |
| ступінь                              | degree              |
| судинний                             | vascular            |
| сукуленти                            | succulents          |
| суміжний                             | adjucent            |
| суміш                                | mixture             |
| супротивний, розташований<br>напроти | opponent            |
| сухий, висушувати                    | dry                 |
| сухість                              | dryness             |
| суцвіття                             | inflorescence       |
| сучасний, поточний, нинішній         | current             |
| схил, узгір'я                        | slope               |
| схильний                             | prone               |
| <b>T</b>                             |                     |
| тварина                              | animal              |
| твердість, міцність                  | firmness            |
| темний                               | dark                |
| темно-зелений                        | dark-green          |
| темрява                              | darkness            |

|                                             |               |
|---------------------------------------------|---------------|
| термін, умова, висловлювати                 | term          |
| теста, насіннева оболонка, насіннева шкірка | testa         |
| тиск, напруга                               | pressure      |
| тип, система, модель                        | pattern       |
| тканина (біол.)                             | tissue        |
| товщина                                     | thickness     |
| тонкий                                      | thin          |
| торгівля                                    | trade         |
| травоїдні                                   | herbivores    |
| трав'яний, трав'янистий                     | herbaceous    |
| транспірація                                | transpiration |
| траплятися                                  | occur         |
| тривалість життя                            | lifespan      |
| тропічний ліс                               | rainforest    |
| турбувати                                   | disturb       |
| тягнути, смикати                            | pull          |
| <b>У</b>                                    |               |
| уламки                                      | debris        |
| умови                                       | conditions    |
| уникати                                     | avoid         |
| унікальний, особливий, неповторний          | unique        |
| урожай, збирання врожаю                     | harvest       |
| урожайність, урожай                         | yield         |
| успішний                                    | successful    |
| утоплення                                   | drowning      |
| утримування                                 | retention     |
| утримувати, зберегти                        | retain, hold  |
| <b>Ф</b>                                    |               |
| ферма                                       | farm          |
| фермент                                     | enzyme        |
| ферментативний                              | enzymatic     |
| фермер                                      | farmer        |
| фісташка                                    | pistachio     |
| форма, вигляд                               | shape         |
| форма, формувати                            | form          |
| формування, утворення, структура            | formation     |
| фосфат                                      | phosphate     |
| фосфатиди                                   | phosphatides  |
| фосфор                                      | phosphorus    |

|                                   |                 |
|-----------------------------------|-----------------|
| фототропізм                       | phototropism    |
| функція                           | function        |
| <b>Х</b>                          |                 |
| хвойні породи                     | conifers        |
| хвороба                           | disease         |
| хемотроніка                       | chemoponics     |
| хімікат                           | chemical        |
| хлор                              | chlorine        |
| хлорофіл                          | chlorophyll     |
| хміль                             | hop             |
| худоба, поголів'я худоби          | livestock       |
| <b>Ц</b>                          |                 |
| цибуля                            | onion           |
| цинк                              | zinc            |
| цінний                            | valuable        |
| цінність, вартість                | value           |
| цукор                             | sugar           |
| цукрова кукурудза                 | sweet corn      |
| <b>Ч</b>                          |                 |
| чагарники                         | shrubs          |
| частий                            | frequent        |
| частина                           | part            |
| частинка                          | particle        |
| частка, частина, доля             | portion, lobe   |
| чашечка                           | calyx           |
| чверть                            | quarter         |
| червоне дерево                    | redwood         |
| червоний бутон                    | redbud          |
| через, крізь, протягом            | through         |
| черешок, стебло                   | stalk           |
| чорні мангри                      | black mangroves |
| чохол, верхівка                   | cap             |
| чутливий, схильний                | prone           |
| <b>Ш</b>                          |                 |
| шавлія                            | sage            |
| шар, пласт                        | layer           |
| широкий                           | wide            |
| шишка                             | pinecone        |
| шишка, конус                      | cone            |
| шкідники                          | pest            |
| шкірка (насінини), плівка (зерна) | hull            |
| шкірястий                         | leathery        |
| шпилька, штифт                    | pin             |
| штовхати, прискорювати, натиск    | push            |

| <b>Щ</b>                         |                   |
|----------------------------------|-------------------|
| щиток                            | shield, scutellum |
| щільний, густий                  | dense             |
| щільність, густина, концентрація | density           |
| щорічно                          | annually          |
| <b>Я</b>                         |                   |
| яблуко ( <i>тип плоду</i> )      | pome              |
| ягода                            | berry             |
| якість                           | quality           |
| ялиця                            | fir               |
| яловичина                        | beef              |
| яскравий                         | bright            |
| яр, ущелина                      | ravine            |
| яроутворення                     | gullying          |
| ячмінь                           | barley            |

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***Навчальний посібник***

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