CHAPTER 15

Sources of Farm Power

OBJECTIVES

At the end of this chapter, students should be able to:

â list the different sources of farm power.
â state the advantages and disadvantages of each type.

15.2 Meaning of Farm Power

Power is defined as the rate of doing work. It is also the expenditure of energy. Farm power refers to the various sources of energy used in doing farm work. The energy is expended on the farm to perform various farming activities which may include all the production and processing activities by farmers.

15.3 Sources of Farm Power

Power or energy needed to do farm work can be obtained from the following sources:

(i) Human power
(ii) Animal power
(iii) Mechanical Power
(iv) Electrical power
(v) Solar power
(vi) Wind power
(vii) Water power
(viii) Biogas

15.3.1 Human Power

This source of power is usually supplied by the farmer. Under subsistence agriculture, the power for doing farm work was originally supplied by human hands only. This was adequate when the farmer produced only for his family needs. Human power is used in stationary work for turning wheels which transmit some power through cogs and pinions in grinding machines and water pumps. The hand method is still extensively used in agriculture for a number of farm operations such as planting of rice, tobacco, potatoes, vegetables; picking or selection of seeds and harvesting.

FIGURE 15.1 A man working on the farm

Advantages of Human Power

1. Man uses his intelligence to control all other sources of farm power.
2. It is readily available and easy to control.
3. Man is needed in the handling and use of farm machines, implements and other sources of farm power.
4. It brings about least damage to soil, crops and is free of pollution.
5. Man can be trained to perform so many operations on the farm.

Disadvantages of Human Power

1. Manâ€™s energy decreases with time, so the output is inconsistent.
2. Man cannot perform tedious farm operations. For example, pulling of trees.
3. The output from human power is relatively small.
4. Man cannot perform at odd periods like when there is heavy rainfall or in very hot weather.
5. Man can fall sick or die easily.
6. If trained or specialized, it may be expensive.

15.3.2 Animal Power

Animal power is derived from cattle, horses, buffalos, donkeys and mules. These animals are used for pulling ploughs, harrows, planters, harvesters and for hauling and transporting farm produce. Animal power is still used in agriculture in many developing countries. Animals are not useful in the supply of stationary power unless special devices are provided for the generation of the power.

Advantages of Animal Power

1. It is a cheap source of farm power.
2. Animals can perform more tedious operations on the farm.
3. Animals do not get fatigued easily.
4. Maintenance of animals is cheap.

FIGURE 15.2 Ox-driven plough

Disadvantages of Animal Power

1. Handling of animals requires a special skill because they can be stubborn and refuse to work when not handled properly.
2. Animal power cannot be used in all farm operations. For example, processing and harvesting.
3. Diseases and pests invation can affect the efficiency of animal power.
4. Work output is lower than that of machines.
5. Animal may not work under heavy
rainfall or very hot weather.
6. Animal can be sick or die.

15.3.3 Mechanical Power

The power is usually provided by the use of machines, such as tractors (Fig. 15.3), cultivators and drills. The use of machines in farming is on the increase. New machines and implements are being produced and old ones re-designed for better efficiency and easier operations. In developed countries, almost every agricultural operation has been mechanized including cultivation, sowing, harvesting, threshing and milking. The most common farm machines and implements are the tractor, plough cultivator, harrow, roller, planter, harvester and thresher.

Advantages of Mechanical Power

1. Machine facilitates the cultivation of large hectares of land (mechanisation).
2. It supplies power to operate farm implements, e.g., ploughs, harrows, ridgers,planters, etc.
3. It can supply power for processing of farm produce.
4. It makes timeliness of operation possible or saves time.
5. It saves human energy, reduces drudgery and makes farm work less tedious.
6. It works faster and more effectively.
7. It reduces labour cost and overall cost of production.

Disadvantages of Mechanical Power

1. High cost of purchase and maintenance of machines.
2. It can breakdown and hold up farm work.
3. The spare parts for the maintenance of machines are not readily available (inadequate spare parts).
4. It requires skilled or trained personnel to operate and maintain the machines.
5. Machines can cause environmental pollution such as soil pollution, air pollution and water pollution.
6. Machines can destroy soil structure (soil compaction).
7. It is not economical to use on small farm holdings.

15.3.4 Electrical Power

The use of electricity in farm operations has increased tremendously and this has increased farm productivity and mechanization. Electricity is used for generating energy for incubators, brooders, drying grains and hay. It is also used for lighting farm houses occupied by farming families, poultry houses, and power for milking machines, water pumps, refrigerators and sterilizing equipment. Electricity supplies power for operating stationary farm machines, particularly in the handling and processing of many farm products and workshop repairs, operation of conveyors and fans. Hence, electricity saves the farmer a lot of time which may be applied for productive activities.

Advantages of Electrical Power

1. Electrical power is effi cient and reliable.
2. It can be converted into heat energy used on the farm for heating and drying.
3. It saves labour and time.
4. It speeds up the rate of operation.
5. It is cheap, neat and free of pollutants.
6. Electrical power is versatile in farming operations.

Disadvantages of Electrical Power

1. Its use is limited to stationary operations; it cannot be used in field operations like land preparation, sowing, weeding and harvesting.
2. It is expensive to install on the farm.
3. It can cause fire outbreak if not properly handled.
4. Electrical power must be controlled before it can perform the intended operation.
5. There may be power failure when the operation is on. And this could cause a greater loss, for example, during incubation and hatching.

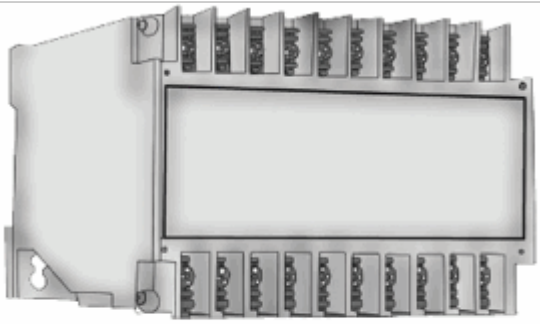

FIGURE 15.4 An electric transmitter

15.3.5 Solar Power

This is the energy derived from the sun, used by green plants to manufacture their food (photosynthesis). Solar energy can also be converted into electrical energy by solar panels and used on the farm to generate power. Solar power can be used in the processing of agricultural produce (drying) like cocoa, maize, beans, rice, melon, fish, pepper and meat. It can also be used in heating farm stead and to operate light farm machinery or equipment.

Advantages of Solar Power

1. It is a free and cheap source of energy.
2. No special skill is needed for its use.
3. It is neat and free of pollutants.
4. It is a reliable source of power for green plants (photosynthesis).

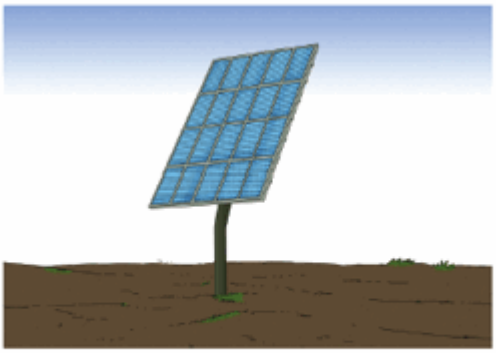

FIGURE 15.5 A solar panel

Disadvantages of Solar Power

1. The supply can be erratic, especially during the rains.
2. It is expensive to store.
3. It cannot be harnessed effectively because it is available only during the day.
4. Change in the atmospheric condition can affect its supply and use.
5. High intensity of sunlight can be harmful and can cause excessive transpiration and evaporation.

15.3.6 Wind Power

This is the process by which air in motion is converted into power for use on the farm. The kinetic energy of the wind is converted into mechanical energy. This is a very unreliable source of power because the wind cannot be controlled and may not be available when required. Wind power has long been used in windmills which have had several designs and modifications. Power is generated by the wind turning the wheel and the amount of power produced depends on the force of the wind. Wind power is used for grinding corn, pumping water, driving small electric generating plants and propelling ships. It can also be used for drying and winnowing farm produce.

Advantages of Wind Power

1. It is a cheap and neat source of power.

2. It can be converted into electricity through wind mill.

Disadvantages of Wind Power

1. Its supply is unreliable or erratic.

2. It is expensive to harness.

3. Its efficiency depends on the force or velocity of the wind.

4. It cannot be used in all farm operations.

FIGURE 15.6 Wind mill

5. Wind can not be controlled or stored.

6. The supply depends on the weather conditions.

15.3.7 Water Power

This is used where the power of water can be harnessed to operate stationary machines. The amount of power developed will depend on the volume of the water, the velocity and the head (the vertical distance through which the water falls to where the water engine is situated). The water engine may be a water wheel, water turbine or water pressure engine. In all these devices, water is made to impinge on the blades, buckets or paddles fixed to the wheels which are made to rotate in order to generate power. The quantity of water can be increased by building dams. The large head of water resulting from big dams turns mighty turbines which produce power for the generation of electricity. An example is the Kainji Dam project.

FIGURE 15.7 Flowing river and dam: Kainji Dam

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Advantages of Water Power

1. The power generated is efficient and reliable.

2. The power is easy to use and is a cheap source when harnessed.

3. Water can be used for irrigation, transportation and processing farm products.

4. It provides water for animals and other uses.

Disadvantages of Water Power

1. The use of water as a source of power can be hindered by weather conditions.

2. It is expensive to harness or operate.

3. The power is irregular in some areas, for example, in the desert.

4. The power generated can only be used for stationary operations (it cannot be used in field operations).

5. Difficult to control and can be destructive during flooding.

15.3.8 Biogas

This is the power generated from the conversion of animal or human waste to produce gas. The waste (faeces) is collected and mixed with water in an air-tight container to undergo biodegradation. During the process of fermentation, methane gas is produced. This gas is collected and stored in gas cylinders. It is used for cooking, heating, brooding, etc. Animal waste can also be used on the farm as organic manure and in fish ponds.

Advantages of Biogas

1. It is very cheap to store and use.

2. It reduces the cost of power source.

3. It makes use of animal waste which would have constituted nuisance on the farm.

4. Reduces environmental pollution on the farm.

Disadvantages of Biogas

1. The waste is not readily available in all the farms.

2. The smell and flies associated with manure can irritate the farmer or the producer.

3.Production requires special skill or training.

4. The power is not widely used by farmers and has a limited use.

15.4 General Uses of Farm Power

1. Power on the farm is applied to field machinery and this field machinery is used for cultivation, preparation of seedbeds, harrowing, sowing of seeds, control of weeds and spraying.

2. After harvesting, the crops may require processing such as drying, threshing, winnowing, cleaning, grading and the processing to reduce bulk or

to obtain the required state of the produce, for example, rice mills, palm oil mills.

Palm kernel cracking machines are supplied mainly by internal combustion

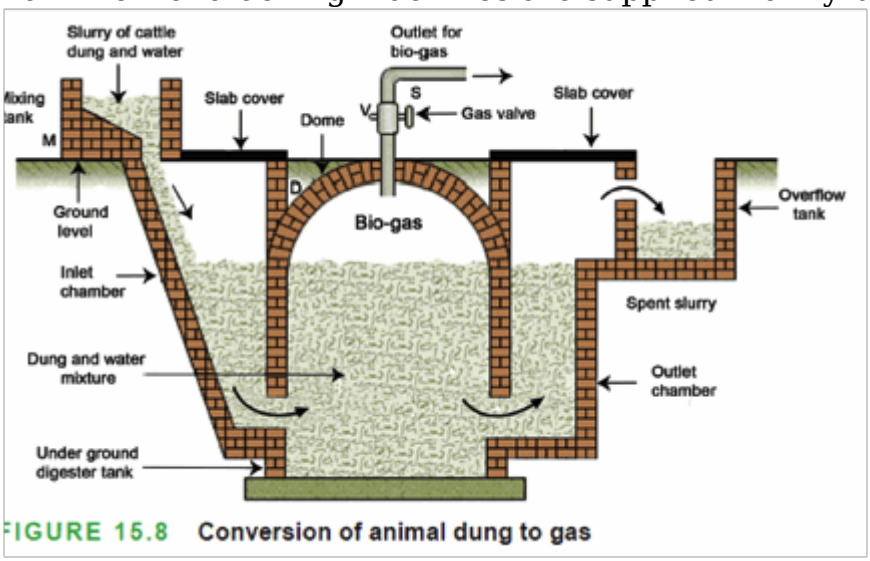

FIGURE 15.8 Conversion of animal dung to gas

engines which may be stationary or mounted on the tractor or electrically operated.

3. The application of power to agriculture has removed the drudgery from farm labour.

4. It has brought about increased agricultural productivity2.

5. It has lowered the cost of production.

6. It has reduced hand labour requirements and, hence, releasing labour to the industry.

Activity 1: Organise an excursion to a commercial farm. Identify the different sources of power used and ask the farm manager to describe how each of the sources are utilised. Which one of them is the best and why?

Activity 2: Form a discussion group and compare different sources of farm power. Suggest ways that can improve the effectiveness of each source of power.

Summary

- There are a lot of activities in production that involve the use of energy to carry them out, and these activities are carried out by the application of physical force (power).
- The common sources of power in our farms are human power, animal power, mechanical power, electrical power, solar power, wind power, water power and biogas. Different types of farm power are used for cultivation, preparation of seedbeds, harrowing, sowing of seeds, control of weeds and spraying against pests of crops after harvesting the crops.
- The application of power to agriculture has many advantages and disadvantages.

Revision Questions

Essay Questions

l. (a) List five sources of farm power.

(b) State the advantages and disadvantages of the listed sources of farm power.
2. (a) State three advantages and two disadvantages of manual labour.
(b) Enumerate four qualities of good draught animals.
(c) State two precautions to be observed when using draught animals.
(d) Explain how power from each of the following sources are harnessed for use on the farm:
(i) Sun (ii) Biogas. (WASSCE 2005)
3. (a) Mention three farming operations that require electrical power.
(b) State three advantages and disadvantages for each of the following types of farm power.
(i) Electrical power (ii) Animal power (WASSCE 1999)
4. Discuss briefly four sources of farm power. (WASSCE 1997)
5. (a) What are the main mechanical sources of farm power?
(b) State two advantages and disadvantages of the following sources of farm power.
(i) Water power (ii) Biogas

Objective Questions

1. Which of the following sources of farm power generates the highest amount of energy?
(a) Human power
(b) Wind power
(c) Animal power
(d) Mechanical power
2. A good draught bull should not have
(a) a deep barrel.
(b) a sloppy rump.
(c) long legs.
(d) strong hooves.
3. The most versatile source of farm power in West Africa is
(a) biogas.
(b) animal.
(c) wind.
(d) water.
4. Considering all costs, the cheapest source of energy for domestic use is
(a) electricity.
(b) sunlight.
(c) biogas.
(d) water.
5. The best source of power used for winnowing rice is
(a) wind.
(b) solar.
(c) human.
(d) electrical.
6. One limitation of water as a source of farm power is
(a) its low level in the reservoir during dry season.
(b) high level of salinity.
(c) high demand for various uses.
(d) high level of pollution.
7. One of the following is not used to provide power on the farm.

(a) Cattle
(b) Horses
(c) Pigs
(d) Camel

8. The following are the advantages of human power except
(a) Man uses his intelligence to control other sources of farm power.
(b) Output is low.
(c) Easily available.
(d) Brings about least damage.

9. Which of the following sources of farm power cannot be effectively used for processing agricultural products?
(a) Machines
(b) Electricity
(c) Animals
(d) Wind

10. Which of the following is the source of energy used by green plants for photosynthesis?
(a) Electrical
(b) Water
(c) Wind
(d) Sun

Answers to Questions

1. (d) 2. (d) 3. (b) 4. (b) 5. (a) 6. (a) 7. (c) 8. (b) 9. (c) 10. (d)