

2.2 MECHANIZED AGRICULTURE AND SOIL COVER IMPACTS

- Mechanized agriculture is the process of using agricultural machinery to mechanize the work of agriculture, greatly increasing farm worker productivity.
- In modern times, powered machinery has replaced many farm jobs formerly carried out by manual labour or by working animals such as oxen, horses and mules.
- Farm mechanization is a term used in a very broad sense. It not only includes the use of machines, whether mobile or immobile, small or large, run by power and used for tillage operations, harvesting and thrashing but also includes power lifts for irrigation, trucks for haulage of farm produce, processing machines, dairy appliances for cream separating, butter making, oil pressing, cotton ginning, rice hulling, and even various electrical home appliances like radios, irons, washing machines, vacuum cleaners and hot plates.”
- The entire history of agriculture contains many examples of the use of tools, such as the hoe and the plough. The ongoing integration of machines since the Industrial Revolution however has allowed farming to become much less labour-intensive.
- Current mechanized agriculture includes the use of tractors, trucks, combine harvesters, countless types of farm implements, aero planes and helicopters (for aerial application), and other vehicles. Precision agriculture even uses computers in conjunction with satellite imagery and satellite navigation (GPS guidance) to increase yields.
- Mechanization was one of the large factors responsible for urbanization and industrial economies. Besides improving production efficiency, mechanization encourages large scale production and sometimes can improve the quality of farm produce. On the other hand, it can displace unskilled farm labour and can cause environmental degradation (such as pollution, deforestation, and soil erosion), especially if it is applied shortsightedly rather than holistically.



Figure 2.2.1 Mechanization in agriculture

[Source:<https://greengoldfarmsghana.com/wp-content/uploads/2019/10/tractor-03-1646x1080.jpg>]

Sustainable mechanization can:

- Increase land productivity by facilitating timeliness and quality of cultivation.
- Support opportunities that relieve the burden of labour shortages and enable households to withstand shocks better.
- Decrease the environmental footprint of agriculture when combined with adequate conservation agriculture practices.
- Reduce poverty and achieve food security while improving people's livelihoods.

Applications

- Preparing land for planting
- Seed drilling, planting
- Weeding, crop spraying
- Harvesting

Benefits of Mechanization of Agriculture:

- It Increases Production
- It Increases Efficiency and Per Man Productivity
- Mechanization Increases the Yield of Land Per Unit of Area
- Mechanization Results in Lower Cost of Work.

- It Contracts the Demand for Work Animals for ploughing water lifting, harvesting, transport etc.
- It Brings in other Improvements in Agricultural Technique
- It Modifies Social Structure in Rural Areas
- It Leads to Commercial Agriculture
- It Solves the Problem of Labor Shortage
- It Releases Manpower for Non-Agricultural Purposes
- It Results in Better Use of Land
- It Increases Farm Income
- It Reduces Fodder Area and Enlarges Food Area

ADVANTAGES OF MECHANIZED AGRICULTURE

Farm mechanization has the following advantages

1. Timeliness of operation

Farm mechanization ensures that all farm operation are done and completed within a given period of time

2. Mechanization saves time

In farm mechanization, all most human efforts are substituted with machines. Hence labour saved could be employed somewhere else

3. Mechanization reduces health hazards

Farm mechanization reduces health hazards including those posed by the use of cutlass, hoe, digger, knives, stumps and pests

4. Mechanization reduces drudgery

Farm mechanization makes it easy to avoid unpleasant manual jobs

5. Mechanization increases farm yield

As a result of mechanization, farmers become richer due to increased yield

6. It encourages large scale farming

With the use of machine which reduces labour and thereby making the work faster and easier, farmers tends to go into large scale farming activities

7. Increase in output

Mechanization makes it possible for farmers to have increase in output

8. It makes specialization of labour possible

Farm mechanization enables people to become specialized in certain operations within the farm.

9. Co-operation among farmers

Mechanization enables many farmers to come together and pool their resources together, thereby promoting or encouraging co-operation among farmers.

10. It saves time:

Mechanization translates quickly the products of man's brain into reality.

11. Reduction in cost of operation:

Mechanization leads to reduction in the cost of agricultural operations per unit output.

12. Improvement in quality of produce:

Mechanization usually improves the quality of some farm produce, e.g., rice processing.

13. Availability of labour for other sectors:

Mechanization also helps to release labour to other sectors of the economy.

14. Use of less human labour:

Mechanization helps to accomplish lots of work with less human labour.

DISADVANTAGES OF AGRICULTURAL MECHANIZATION

Farm mechanization has the following disadvantages

1. High cost of running:

Farm mechanization, due to the high cost and numerous machines involved, is very expensive to operate

2. Displacement of workers:

In farm mechanization, very few workers are required. Hence many people will be out of job when mechanization is introduced

3. Compaction of soil:

Mechanization lead to compaction of soil due to the movement of heavy machines

4. It causes environmental pollution:

Mechanization causes environmental pollution due to smokes emanating from engines of these machines, chemicals and the use of fertilizer

5. Degradation of landscape:

Mechanization leads to degradation of landscape due to or as a result of continuous excavation

6. Land tenure system:

Land system may hinder efficient use machines like tractors, bulldozer due to small holdings of farmland

7. Destruction of soil structures:

The soil structure can easily be destroyed due to continuous use of heavy machines

8. Redundancy of farm labour

With farm machines working on the farms, the work can easily be completed and this situation can create redundancy in farm labour

9. Few crops can be mechanized

Very few crops like maize, rice, millet and guinea corn that easily be mechanized

10. Inadequate technical know-how

There is always inadequate technical know-how in handling the farm machines and equipment in most developing countries of the world

11. Damage to crops

Most crops are easily damaged during mechanize farm operation

12. Inadequate spare parts

Most of the spare parts or replacement parts for most of these machines are not readily available

13. High cost of maintenance

There is usually high cost of maintenance of machines involved in mechanized agriculture especially for the heavy duty machines

14. Spread of pest and diseases

Mechanization helps to spread diseases through contaminated machineries

15. Human control

Mechanization needs human labour to control it

16. Unstable fuel supply

Unstable supply of fuel in the international market can easily affect the use of these machines in mechanized agriculture

SOIL COVER IMPACTS

Soil cover refers to vegetation, including crops, and crop residues on the surface of the soil.



Figure 2.2.2 Soil Cover

[Source: https://infonetbiovision.org/sites/default/files/environmental_health/conservationagriculture/2855.400x400.jpeg]

Soil cover and reforestation is a mechanism to protect soil from water loss. Like the protection of an umbrella, soil cover and reforestation protects the soil and the microbes within from the impact of sun heat, rain and wind. It stops the soil surface from sealing, and reduces the amount of precious rainwater that runs off.

Introduction

With a reduction of moisture loss in the soil, groundwater resources are protected, soil quality and agricultural production can be improved, and water use for irrigation can be decreased, thus optimizing the local water cycle.

Soil moisture loss (and also soil degradation) can be minimized through different techniques of soil moisture conservation:

- Soil cover (with living plants) and
- Reforestation,
- Mulching,
- Different tillage techniques, and
- Soil amendments.

Soil cover is common on agricultural land. Reforestation is common to protect water protection areas and groundwater resources, or to prevent soil degradation in non-agricultural sites.

Benefits of Soil Cover

As a result of soil cover, agricultural production subsequently improves because soil cover both promotes and maintains,

- Optimum soil conditions for plant growth (nutrient availability) and
- Water infiltration (water availability).

Soil cover with living plants (soil can also be covered with mulch) protects the soil surface from rain, wind and sun (FAO 2005):

- It reduces soil erosion and protects the fertile topsoil, thus preventing the silting of rivers and lakes.
- It stops the soil surface from sealing, and reduces the amount of precious rainwater that runs off.
- It suppresses weeds by smothering their growth and reducing the number of weed seeds. This reduces the amount of work needed for weeding.
- It increases the soil fertility and the organic matter content of the soil.
- It increases soil moisture by allowing more water to sink into the ground and by reducing evaporation.
- Decomposing vegetation and the roots of cover crops improve the soil structure and make the clumps and lumps in the soil more stable – making it harder for rain to break them up and wash them away.
- Earthworms and other forms of life can prosper in the cover as well as in the soil.
- Soil cover stimulates the development of roots, which in turn improve the soil structure, allow more water to soak into the soil, and reduce the amount that runs off.

Types of soil cover:

1. Living plant material: crops, cover crops and forest structures.

2. Dead plant material: such as crop residues and pruning from trees and shrubs

Operation and Maintenance:

Soil cover management needs expert knowledge. The following list outlines some challenges you may encounter for maintaining soil cover and some ways to overcome them (adapted from FAO 2005):

➤ **Semi arid areas:**

In semi-arid areas, where there is little rain and most of it falls in one season, establishing a cover crop may be difficult. Crops, shrubs and trees produce few residues, and farmers often need them for feed or building materials. Cover crops use precious water.

➤ **Diseases and pests:**

Diseases and insect pests might attack the cover crop and will require special attention. Farmers often use fire to destroy pests and diseases. But this leaves the soil bare and destroys valuable organic matter.

➤ **Rats:**

A dense cover crop may encourage rats, which may attack the crop. Slash cover crop as close to the ground as possible, use traps (poison could kill other animals as well), or use rotating crops (interrupt food supply).

➤ **Termites:**

Many farmers fear that soil cover will attract termites. Only a few types attack crops, most of them are important (break down of soil organic matter, aeration).

➤ **Fire:**

Bushfires or uncontrolled fires on neighbouring fields can spread into a conservation agriculture field and destroy its soil cover. To prevent this, you can leave a buffer zone around your field.

➤ Livestock:

Livestock need to be fed. Farmers often allow them to graze on stubble or on fallow fields, and other livestock owners may not keep their animals out of a field planted to a cover crop. This may especially be a problem in dry years or in semi-arid areas, where few alternative sources of feed are available. Fence crop field or find alternatives.

Advantages

- Increases soil fertility and soil moisture
- Protects soil from sun, wind and rain, reducing evaporation and compaction
- Plant debris provides organic matter and nutrients to the soil
- Reduces erosion
- Prevents silting of rivers, lakes and reservoirs
- Reduces runoff and enhances infiltration
- Reduces work for weeding

Disadvantages

- Pesticides may need to be used.
- To prevent from bushfires, a buffer zone around the field is necessary